ENCLOSURE 2 - Form 2C Item IV-B and Form 2F Item II-B

ZINC SOURCE / MINIMIZATION STUDY OUTFALL 905 (005)

Hercules Incorporated (now owned by Ashland Inc.) has been conducting a source investigation for the zinc contamination at Outfall 905 (005 being the non-rain-event designation of the Outfall). This report generally references the quarterly reports submitted July 2005 through July 2009. (Ref: Permit Part I.C.9.)

Because Outfall 005/905 services roadways near many of the plant's processes (Ref: Site Drainage Map), we initially presumed the zinc source to be onsite. The potable service water used for manufacturing and as fire water may contain zinc at levels similar to what regular monitoring showed at Outfall 005 (typically 200-250 µg/L). We tracked down and repaired the few potential service water leaks that we found. No step-change improvement in zinc concentrations were observed at 005. We contacted Groundwater Environmental Services (GES) to help find the source(s). Their field sampling in May 2005 consisted of manhole sampling of the 005 drainage area with emphasis near the manufacturing and maintenance areas. They observed that the further north (upgradient) the sample was taken, the higher the Zn content would be and the lower the pH (acidic). They concluded the Zn source was located either in the northern portion of the plant or upgradient (north) of the site. Lowest pH and highest zinc were observed in the sewer parallel and adjacent to our north boundary. (See Attachment 1: GES report dated July 6, 2005.) Additional sampling along the northern boundary was recommended to better source the zinc, which appeared to be associated with low pH (not surface) water entering the storm sewer system. Low pH groundwater tends to keep metals in solution or solubilize metals attached to particulates. It is believed that it is this low pH groundwater at the north boundary that has resulted in the dissolution of various inorganic compounds, namely copper and zinc, that have resulted in permit compliance issues for Ashland at Outfall 005.

On August 26, 2005, routine sampling of Outfall 005 determined pH of 4.3. Using pH indicator paper, we traced the source of the low pH through the 005 storm sewer system to a single manhole 14 feet from our north property line (Ref.: FAX to DEQ, Perkinson to Kelly, August 27, 2005). This manhole is referred to hereinafter as the 'north manhole" (NMH). Into it, a single culvert discharges water (1-2 gpm) in dry weather from under and sometimes beyond the CSX rail yard. The culvert appears to receive stormwater from an area of some acres north of the rail yard. The culvert is identified as Intake 007 Site Plant Map #1 Storm Drainage System. NMH is located about 1100 feet east of the lowest pH/highest Zn finding in the initial GES study. The 3000-foot-long by 9-track-wide rail yard parallels most of the north boundary of our plant. A variety of rail cars are parked here including scores of coal and molten sulfur cars (potential acidity sources). There is common evidence of incidental spillage in the rail right-of-way. Yellow streaks on the upper exterior of some molten sulfur tankers suggest releases which may be washed by rainwater. Knowing that acidity commonly mobilizes metals, we sampled the manhole (8/26 and 8/28) and found the following metals, respectively: Al = 10,100 and 9,600 µg/L; Cu = 160 and 138 µg/L; Zn = 397 and 356 µg/L; Fe = 246 and 342 µg/L. The following anions were also reported: SO_4 = 240 and 230 mg/L; NO_4 = 23.1 and 22.8 mg/L. We have since mitigated the effect of the acidic influent with (typically) two bags of lime a week added to 005 sewer system downgradient of the influent. Outfall 005 is about 2000 feet southeast of NMH (Ref: Site Storm Drainage Map #1 and August 2005 DMR's Attachment 1).

GES then installed an initial shallow groundwater well (NMH-1) proximal to NMH to determine to assess groundwater near the NMH. This work found acidic perched or shallow groundwater and soils at elevations approaching the elevation of the pipe flowing into the NMH. This water had zinc concentration as high as 1283 µg/l and acidity in the 4-5 pH range. (Ref.: Attachment 2: GES report October 6, 2006.) This report also contains photos of the type evidencing incidental sulfur spillage mentioned above.

For CSX (the adjourning land owner) and Hercules, URS (consultant) conducted a closed circuit TV field study of the influent sewer on January 19, 2007. Their resulting report indicated the approximately 150-foot by 18-inch concrete sewer pipe that passes under the rail yard is fractured and deformed along its length and is allowing significant infiltration ranging in severity from weepers to water running into the influent pipe. Also, the receiving NMH is old and could allow some additional infiltration. The report (March 2007) recommended inserting a 14-inch plastic pipe liner to repair the 18-inch pipe that is being infiltrated, as well as repairing Hercules' manhole. A favorable hydraulics and hydrology (H&H) study was needed to confirm if a slip-lined pipe would still have effective diameter to provide adequate stormwater drainage to a significant drainage area at the intake end of the pipe and north of CSX property.

Hercules then engaged GES to assess whether the proposed work would be expected to eliminate problem of acidic water entering 005 sewers. They installed five (5) piezometers along 900 feet of Hercules' northern boundary and extending inward by about 45 feet. This acidic soil and groundwater were found along the length of the boundary studied and diminishing inwardly from the boundary. GES also collected data from ten (10) existing storm drain manholes during this investigation. Acidic conditions were detected during the storm drain manhole surface water sampling as well. See Attachment 3: GES report dated December 2007.

Recognizing Hercules' concern for addressing the source of acidity, CSX agreed to partner in installation of seven (7) piezometers north (on the far side) of CSX right of way. CSX and Hercules contracted consultant AMEC to do this work. North of the rail yard, AMEC found all pHs in the 5-6 SU range, so no source was found north of the rail yard. Hercules contracted GES to install an additional four (4) piezometers along the north property boundary of the Hercules facility. GES' findings are summarized in Attachment 4 (GES letter report dated August 10, 2009) to this minimization study document. Based on the data collected from this 2008 work, it is estimated that the sewer influent to the NMH may contribute 20-25% of the acidic water collected in Hercules 005 drainage system from upgradient parallel boundary along the tracks.

AMEC completed the H&H study. Because the 14" pipe lining may not accommodate all storm events upon the significant drainage area north of the tracks, they recommended slip-lining the culvert to minimize influx of low pH groundwater into the NMH on Hercules property. Slip-lining would retain 16" to 17" of pipe diameter. Additionally, CSX requests Hercules reline the NMH to optimize effectiveness of the relining.

CSX recently bid-out for the pipe lining replacement/manhole repair. Hercules plans to cooperate with the proposed effort to minimize drainage from their site. We will then evaluate the effectiveness of planned corrective measures and determine if additional measures are needed to control any influent contamination.

Attachment 1: GES letter report, dated July 6, 2005
Attachment 2: GES letter report, October 6, 2006
Attachment 3: GES Northern Property Boundary Assessment Report, dated December 2007
Attachment 4: GES letter report, dated August 10, 2009

ATTACHMENT 1

Groundwater
& Environmental Services, Inc.

Exchange Alley Building • 23 South 13th Street, Suite 201 • Richmond, Virginia 23219 • (866) 222-7786 • (804) 343-0770

July 6, 2005

Via electronic and regular mail
Mr. William E. Perkinson
Environmental Engineer
Hercules Incorporated - Aqualon Division
1111 Hercules Road
Hopewell, VA 23860-5245

Re: Zinc Investigation
Hercules – Aqualon, Hopewell, Virginia

Dear Mr. Perkinson:

Groundwater & Environmental Services, Inc. (GES) is pleased to provide Hercules Incorporated (Hercules) with this report documenting the environmental sampling performed at the Aqualon facility in Hopewell, Virginia. The aqueous samples collected on May 23, 2005 were intended to characterize the distribution of total zinc among the various sources discharging into Outfall 005 on the eastern portion of the Aqualon facility. All field sampling activities were performed by GES personnel, and all analytical testing was performed by Severn Trent Laboratories (STL) of North Canton, Ohio.

SAMPLING ACTIVITIES

On May 23, 2005, GES personnel collected a total of 13 aqueous samples from the Aqualon facility in order to investigate the extent and distribution of total zinc in components of the stormwater management system discharging to Outfall 005. Samples were collected at the following locations:

1) One (1) sample at the permitted Outfall 005;
2) One (1) sample at the stormwater outlet discharging into Bear Creek, approximately 100 feet upgradient of the permitted outfall;
3) Two (2) samples from Bear Creek at locations approximately 10 feet and 75 feet upgradient of the stormwater outlet;
4) Seven (7) samples from stormwater manholes connected to the portion of the stormwater management system that drains to Outfall 005; and
5) Two (2) samples of the tap water being supplied to the facility by Virginia American Water Co. Tap Water 1 was collected from the lavatory facilities at the Main Gate Guardhouse, and Tap Water 2 was collected from a sink at the Environmental Training Building.

Figure 1 shows the approximate locations of each of the sampling points on the facility site map. The samples were collected throughout the day on May 23; according to the rain gauges maintained by the facility, no rainfall had fallen at the facility for at least 48 hours prior to the sampling activities.

Prior to sample collection, GES personnel collected water quality field parameters at each sample location using a Horiba U-22 flow-through cell. The recorded measurements of pH, conductivity, turbidity, dissolved oxygen, temperature, total dissolved solids, and oxidation-reduction potential are documented

in **Table 1**. The sampling team also visually estimated the total depth and the quantity of flow visible in each of the seven sampled manholes; the collected field observations along with estimated surface elevations from a topographic map are presented in **Table 2**.

Samples at Outfall 005, Bear Creek, and the seven stormwater manholes were collected using a swing-sampler fitted with clean, laboratory-provided bottleware. The aqueous samples were then transferred to laboratory-provided bottleware pre-preserved with nitric acid. The two Tap Water samples were collected directly from the sink outlets into the pre-preserved bottleware. The water was allowed to flow freely for an approximate two-minute period prior to sample collection. All of the collected samples were packaged in shipping coolers in wet ice, and shipped under chain-of-custody to STL for laboratory analysis.

GES personnel also utilized a HACH field test kit to measure zinc concentrations in the field. The test kit was used at three sampling locations to evaluate the correlation between the field results and the laboratory analytical results.

CHEMICAL ANALYTICAL ZINC RESULTS

STL analyzed the collected aqueous samples for total zinc in accordance with USEPA SW846-6010. The laboratory reported that all samples were received under chain-of-custody in good condition, and that the requested testing was performed within hold times. A summary of the test results is presented in the attached **Table 1**. Test results from the samples collected directly from the stormwater management system varied from 0.18 mg/L at Outfall 005, to 0.61 mg/L at stormwater manhole SDM-01. The two Tap Water samples collected from the facility's water supply system varied from 0.15 mg/L at the Environmental Training Building, to 0.68 mg/L at the Main Gate Guardhouse.

The HACH field test kit for zinc analyses was performed on three samples: at manhole SDM-04, Creek 2 in Bear Creek, and at Outfall 005. Although the field test kit results varied from 0.03 mg/L to 0.5 mg/L, the results showed a very poor correlation with the analytical testing performed by the laboratory. Results of the HACH testing are summarized in **Table 1**.

CONCLUSION AND RECOMMENDATIONS

Based on the analytical test results of the collected samples, the highest levels of zinc were identified in two samples: in the upgradient manhole SDM-01 (0.61 mg/L), and in Tap Water 2 collected at the Main Gate (0.68 mg/L). Samples collected from other sampling points exhibited progressively lower levels of zinc in downgradient locations, culminating in the detection of 0.18 mg/L at the outfall itself. The apparent distribution of zinc levels in the collected samples indicates that a major source of the identified zinc is located either in the northern portion of the site property, or upgradient of the site property. Current and historical uses located upgradient (north) of the site property include the rail lines, an auto repair and salvage yard facility, an alum manufacturer, and a china manufacturer.

Based on the work performed, the following action items are recommended for additional evaluation:

1) Confirm the elevated levels of total zinc in the tap water sample through resampling. As a public water supply company, Virginia American Water Co. should also be able to supply results of zinc analyses performed on their water supply for comparison against the site-specific results.
2) Further characterize the total zinc levels along the northern (upgradient) boundary of the site property by additional sampling efforts. In addition to the resampling of the initial sampling

points, additional samples should be collected from the various manholes along the access road running adjacent to the northern property boundary. Based on the work performed during the May field sampling activities, a small crane or hoist may be necessary to remove the manhole covers at these additional sampling locations.

3) Continue to work with both the facility's Pollution Prevention Team and the facility operating personnel in the relevant process areas to identify any potential sources of zinc entering into the stormwater management system. Based on the identification of the elevated zinc levels in sample Tap Water 1, the identification and potential elimination of any leaks in the water supply system may also assist with reduction of the zinc levels.

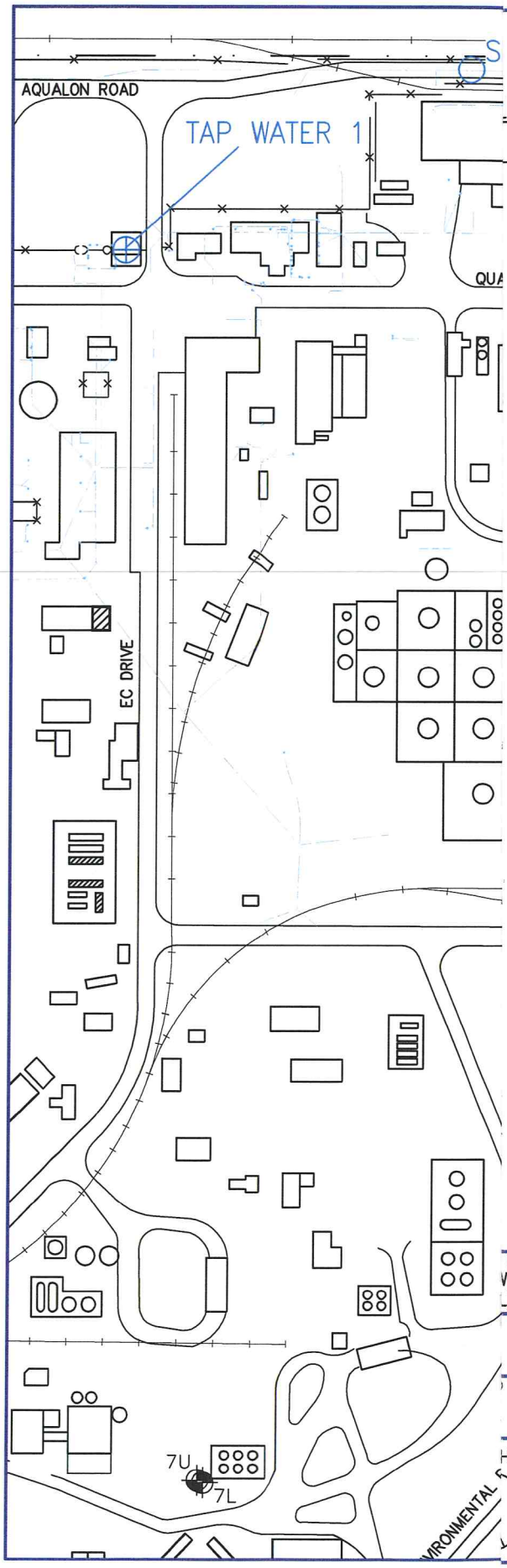
The anticipated schedule for these additional action items is during the 3rd Quarter of 2005. If you have any questions or require any additional information regarding the above-described work activities, please do not hesitate to contact the undersigned for assistance.

Respectfully submitted,

Groundwater & Environmental Services, Inc.

Samuel C. Nicolai, P.E.
Project Manager

Attachments: Figure 1: Zinc Investigation Map
Table 1: Zinc Investigation Analytical Summary
Table 2: Zinc Investigation Field Observations



LEGEND

- DRAINAGE
- OUTFALL LOCATION
- GROUNDWATER MONITORING WELL
- SURFACE WATER MONITORING POINT LOCATIONS
- STORM DRAIN MANHOLE SAMPLE LOCATION
- TAP WATER SAMPLE LOCATION
- BEAR CREEK SAMPLE LOCATION
- STORM DRAIN OUTLET SAMPLE LOCATION

BY:

BY:

BY:

ZINC INVESTIGATION MAP

HERCULES INCORPORATED
AQUALON DIVISION
HOPEWELL, VIRGINIA

Groundwater & Environmental Services, Inc.
23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219

SCALE IN FEET	DATE	FIGURE
0 — 180	6-9-05	1

M:\Graphics\1200-Richmond\Hercules\Hopewell (ERM figures on CD)\hopewell figure 1 (FULL SITE MAP).dwg, 6/9/2005 3:53:00 PM, WWesterlund

Zinc Investigation - July 2005

Hercules Incorporated - Aqualon Division

Hopewell, Virginia

Table 1: Zinc Investigation Analytical Summary

Sample ID	Physical Parameters							Laboratory Zinc Results	HACH Zinc Results
	pH	Conductivity	Turbidity	DO	Temperature	Total Dissolved Solids	Oxidation Reduction Potential		
		mS/cm	*NTU*	*mg/L*	*°C*	*g/L*	*mV*	*mg/L*	*mg/L*
SDM O1	4.70	0.734	89.1	8.61	17.9	0.47	164	**0.61**	NM
SDM O2	5.55	0.696	128.0	10.68	18.6	0.46	70	**0.30**	NM
SDM O3	6.48	0.638	155.0	10.84	19.8	0.41	38	**0.27**	NM
SDM O4	6.19	0.665	143.0	13.05	19.4	0.043	51	**0.32**	**0.05**
SDM O5	6.73	0.464	117.0	11.08	22.1	0.31	222	**0.24**	NM
SDM O6	6.50	0.694	147.0	13.18	19.5	0.45	49	**0.31**	NM
SDM O7	5.95	0.718	230.0	9.44	20.0	0.46	17	**0.37**	NM
Outfall 005	6.28	0.720	70.2	7.16	21.2	0.46	143	**0.18**	**0.03**
SDO	6.20	0.658	130.0	9.98	20.7	0.42	59	**0.32**	NM
B Creek 1	6.59	1.34	595.0	10.47	27.0	0.90	76	**0.30**	NM
B Creek 2	7.10	1.61	317.0	8.21	24.2	1.00	95	**0.18**	**0.5**
Tap Water 1	6.39	0.237	0.5	9.30	25.2	0.15	403	**0.68**	NM
Tap Water 2	6.42	0.428	13.9	9.71	24.7	0.16	621	**0.15**	NM

NM=Not Measured

Table 2: Zinc Investigation Field Observations

Sample ID	Estimated Surface Elev.	Depth to Bottom of Storm Drain	Estimated Storm Drain Elev.	Estimated Depth to GW	Approximate GW Elev.	Flow Rate Observations (gal/min)
SDM O1	41	8	**34**	20	**21**	1-2 gal/min
SDM O2	39	12	**27**	20	**19**	North DI = 1-2 gal/min, West DI =15-20 gal/min
SDM O3	39	16	**23**	19	**20**	0.5 gal/min
SDM O4	40	17	**23**	20	**20**	1-2 gal/min
SDM O5	41	13	**28**	20	**21**	1 gal/min
SDM O6	40	13	**27**	20	**20**	12-15 gal/min
SDM O7	40	11	**29**	20	**20**	8-10 gal/min

Units of Depth in Feet GW=Groundwater DI=Drop Inlet

ATTACHMENT 2

Groundwater
& Environmental Services, Inc.

Exchange Alley Bldg., 23 S. 13th Street, Suite 201 • Richmond, Virginia 23236 • (804) 343-0700 • (804) 343-0770 FAX

October 6, 2006

Mr. William E. Perkinson
Environmental Engineer
Hercules Incorporated
1111 Hercules Road
Hopewell, Virginia 23860-5245

Re: Summary of Groundwater Investigation
Hercules – Aqualon, Hopewell, Virginia

Dear Mr. Perkinson:

Groundwater & Environmental Services, Inc. (GES) is pleased to present this letter report documenting the monitoring well installation and sampling activities associated with NMH-1 at the Hercules – Aqualon facility (Site) in Hopewell, Virginia. The work activities were performed in accordance with the GES Workplan for Environmental Services dated May 23, 2006.

Monitoring Well Installation

On May 31, 2006, GES personnel mobilized to the Site to install monitoring well NMH-1 in the facility access road along the northern boundary of the site property, near the underground stormwater line originating in the adjacent railroad right-of-way. The purpose of the proposed well was to provide a subsurface sample point for groundwater quality at the upgradient edge of the property near the existing stormwater line.

Installation activities were conducted by a two-man crew from Parratt-Wolff Inc. of Hillsborough, North Carolina, under the direction of an experienced GES field scientist. Prior to the well installation, Parratt-Wolff personnel saw-cut the concrete gutter, and hand-augered to approximately four feet below ground surface (bgs) to clear for potential underground utilities. The well installation was performed using direct-push technology with a truck-mounted rig to the terminal depth of 21 feet bgs. Ten feet of one-inch PVC well screen was set from 11 feet to 21 feet bgs, and clean filtration-grade sand was placed in the annular space up to three feet bgs. Two feet of bentonite was placed above the sand, and the borehole was then grouted to within a few inches of the ground surface. A one-inch gripper plug was installed in the PVC casing to prevent potential surface water infiltration. GES and Parratt-Wolff personnel returned to the site on June 12, 2006 to install a steel flush-mount protective cover and small concrete pad at the surface.

Soil samples collected during the well installation indicated tan and tan-orange sandy silts down to approximately 12 feet bgs, underlain by a brief organic layer and a two-foot layer of clay. From 15 feet bgs to the terminal depth, the boring encountered the tan-orange saturated sands of the uppermost aquifer at the Site. No visual or olfactory evidence of environmental impacts was identified during the soil sampling or well installation activities. Representative soil samples were collected from the four-foot sample sleeves, mixed with deionized water into a slurry, and tested for pH using color-change test strips. pH results included 4.30 at 8 feet bgs, 4.22 at 12 feet bgs, and 5.12 at 16 feet bgs.

Water was first encountered in the boring at approximately seven feet bgs, and all lower soil samples were visibly wet. After completion of the well, the static water level stabilized at 18.55 feet bTOC.

The attached NMH-1 boring log summarizes the observed lithology, water levels, pH soil screening results, and well construction information.

Aqueous Sampling

On June 6, 2006, GES personnel returned to the Site to collect a groundwater sample from monitoring well NMH-1. Prior to sampling, the well was purged with a peristaltic pump and disposable polyethylene tubing until a turbid-free discharge was obtained. During purging activities, the water level in the well was quickly drawn down, indicating a low level of recharge from the surrounding formation and/or that the well water level may be influenced by intermittent perched water from precipitation. pH was measured using an Oakton pH meter and exhibited a reading of 4.12. Once the water level had recharged, one aqueous sample was collected in laboratory-provided bottleware, packed in ice, and transported under chain-of-custody to Universal Laboratories (Universal) of Hampton, Virginia for analysis.

In addition, a second aqueous sample was collected from the nearby stormwater manhole located in the middle of the facility access road. The sample was collected with a disposable polyethylene bailer from the constant flow in the manhole, at an elevation of approximately 11 feet bgs. The sample was containerized and handled in a similar manner as described above. The requested analytical testing for both aqueous samples included dissolved metals in accordance with EPA test methods 200.7, SM-3111 B (sodium only), and SM-3112 B (mercury only).

Disposable sampling materials, including the downhole polyethylene tubing, silicon pump tubing, and nitrile sampling gloves, were disposed of onsite as nonhazardous solid waste. Soil cuttings and soil sample remnants were placed in a clean fiber drum for proper disposal by Hercules pending analytical testing results.

Analytical Results and Screening

Analytical test results of the two aqueous samples are reported in the Universal Report of Analysis attached to this letter. None of the detected metals exceed the April 2006 EPA Region III Risk-Based Concentrations (RBCs) for Tap Water. However, in comparison to previously collected inorganic data from downgradient monitoring wells, the concentrations of zinc and copper appear elevated in the two June 2006 samples. In particular, the maximum concentration of 1.283 mg/L of dissolved zinc in the groundwater sample is nearly two magnitudes higher than the concentrations of zinc detected in downgradient monitoring wells.

Conclusions and Recommendations

Based on the collected water level measurements and on historical knowledge of groundwater flow at the Site, the true groundwater table in the vicinity of monitoring well NMH-1 is anticipated to be located at approximately 18 to 20 feet bgs. However, the wet soils observed during the well installation, and the presence of the constant flow in the nearby stormwater manhole indicate that perched water exists at elevations as high as seven feet bgs in the vicinity of monitoring well NMH-1. The perched water is likely the result of recharge from precipitation, restricted by the low-permeability clay observed at approximately 13 feet bgs. Based on the amount of impervious surface in the vicinity of the well (asphalt parking lots and drives, nearby facility structures), the majority of the infiltration is originating from the bare, graveled, and grassed areas in the railroad right-of-way and adjacent properties to the north. Given the age of the stormwater line, direct leakage from joints or any damaged areas in the underground line may also play a role in the recharge of the observed zone of perched water.

Both the groundwater sample from monitoring well NMH-1 and the aqueous sample collected directly from the nearby stormwater manhole are representative of offsite, upgradient water quality. Various

historical investigations at the Site have shown that site-specific groundwater flow is to the south and to the east, discharging to the small onsite creeks that bisect the property. Although the stormwater manhole does accept surface water from the two adjacent curb inlets in the Hercules facility access road, the bulk of the observed flow appears to originate from the offsite properties to the north, including the adjacent railroad right-of-way.

During the well installation and sampling activities, small piles of sulfur and other materials were observed on the ground in the railroad right-of-way north of the Site. The materials are the accumulation over time from the various railroad cars that pass through this area to many of the other industrial facilities in the Hopewell, Virginia area. It should be noted as well that during well installation and sampling activities, coal and sulphur railroad cars were noticed parked on the railroad tracks with evidence of spills. Several piles of solid, yellow, material were observed on the northern railroad property just north of the fenceline separating the Aqualon facility from the railroad property.

The results of the pH screening of the soil samples, and the analytical detections of zinc and copper in the two collected aqueous samples indicate that onsite subsurface soil and water quality are being influenced by offsite sources. Downgradient sampling results of both groundwater and stormwater collected during previous investigations show increases in pH and decreases in detected concentrations of metals. Based on the work performed and the corresponding analytical test results, GES recommends notification of the Virginia Department of Environmental Quality to assist with the identification and correction of the source of the offsite impacts.

GES appreciates the opportunity to work with Hercules on this matter. Should you have any questions, please feel free to contact the undersigned.

Respectfully submitted,
Groundwater and Environmental Services, Inc.

Samuel C. Nicolai, P.E.
Senior Project Manager

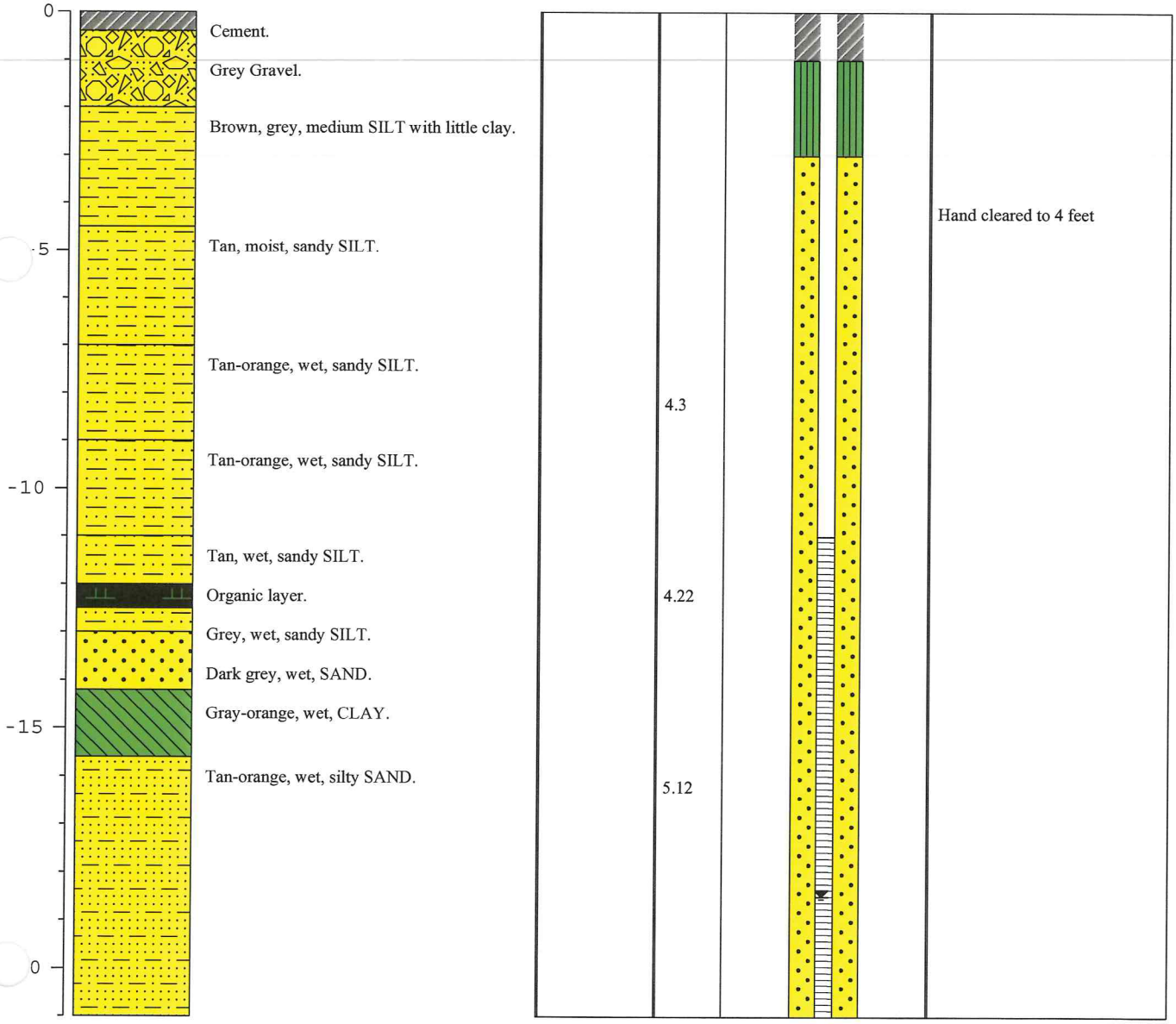
Attachments: Boring Log – NMH-1
Universal Report of Analysis

Soil Boring Log

Borehole Number: NMH-1

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Hercules Aqualon**	DRILLING CO.:	**Parratt-Wolff**
SITE LOCATION:	**Hopewell, Virginia**	DRILLER:	**Arnold Chapel**
JOB NAME:	**1200850**	RIG TYPE:	**Geoprobe**
LOGGED BY:	**Erin Nugent**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Samuel Nicolai**	SAMPLING METHODS:	**4-foot macro-core**
DATES DRILLED:	**5-31-06**	DROP HAMMER WEIGHT	**Safety Hammer**
BOREHOLE NO.:	**NMH-1**	TOTAL DEPTH:	**21**
WEATHER: Overcast, 80s		▼ Observed Water Level	
		NA = Not Applicable	

DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	BLOW COUNT	pH	WELL CONSTRUCTION	NOTES



UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666
1-800-695-2162
(757) 865-0880
Fax: (757) 865-8014
E-mail: info@universallaboratories.net

Date: Thursday, June 15, 2006

Pages: Page 1 of 5

To: Bill Perkinson
Hercules (Hopewell Plant)

Fax#: (804) 541-4492

From: Monica Rollins

Subject: Results for Project N/A
designated as UL Order Id 0606171 and received on Friday, June 09, 2006

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
0606171-001

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0606171

(REPORT DATE)
15-Jun-06

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: N/A
Project # N/A
Site: North Manhole
Matrix: Wastewater
Comments for Order:

UL Sample Number: **0606171-001**
Sample ID: North Manhole
Grab Date/Time: 6/8/2006 12:00
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Aluminum (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Antimony (dissolved)	EPA 200.7	<	mg/L	0.001	6/12/2006 11:27:00	JP
Arsenic (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Barium (Dissolved)	EPA 200.7	**0.034**	mg/L	0.005	6/12/2006 11:27:00	JP
Beryllium (Dissolved)	EPA 200.7	**0.003**	mg/L	0.001	6/12/2006 11:27:00	JP
Cadmium (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Calcium (Dissolved)	EPA 200.7	**35.7**	mg/L	0.1	6/13/2006 10:33:00	JP
Chromium (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Cobalt (Dissolved)	EPA 200.7	**0.023**	mg/L	0.001	6/12/2006 11:27:00	JP
Copper (dissolved)	EPA 200.7	**0.105**	mg/L	0.001	6/12/2006 11:27:00	JP
Iron (Dissolved)	EPA 200.7	**0.20**	mg/L	0.05	6/12/2006 11:27:00	JP
Lead (dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Magnesium (Dissolved)	EPA 200.7	**9.81**	mg/L	0.05	6/13/2006 10:33:00	JP
Manganese (Dissolved)	EPA 200.7	**0.820**	mg/L	0.005	6/12/2006 11:27:00	JP
Nickel (Dissolved)	EPA 200.7	**0.022**	mg/L	0.005	6/12/2006 11:27:00	JP
Selenium (Dissolved)	EPA 200.7	<	mg/L	0.001	6/12/2006 11:27:00	JP
Silver (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 14:26:00	JP
Thallium (Dissolved)	EPA 200.7	<	mg/L	0.001	6/12/2006 11:27:00	JP

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
0606171-001

Total Potassium	EPA 200.7	**7.3**	mg/L	3.5	6/13/2006 10:33:00	JP
Vanadium (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Zinc (dissolved)	EPA 200.7	**0.370**	mg/L	0.005	6/12/2006 11:27:00	JP
Sodium (Dissolved)	SM-3111 B	**24.62**	mg/L	0.05	6/13/2006 10:22:00	JP
Mercury (Dissolved)	SM-3112 B	**0.0013**	mg/L	0.0002	6/13/2006 10:11:00	WK

Comments for Sample I 0606171-001

No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0606171

(REPORT DATE)
15-Jun-06

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: N/A
Project # N/A
Site: Groundwater
Matrix: Wastewater
Comments for Order:

UL Sample Number: 0606171-002
Sample ID: groundwater
Grab Date/Time: 6/8/2006 12:03
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Aluminum (Dissolved)	EPA 200.7	**0.018**	mg/L	0.005	6/12/2006 11:27:00	JP
Antimony (dissolved)	EPA 200.7	<	mg/L	0.001	6/12/2006 11:27:00	JP
Arsenic (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Barium (Dissolved)	EPA 200.7	**0.027**	mg/L	0.005	6/12/2006 11:27:00	JP
Beryllium (Dissolved)	EPA 200.7	**0.007**	mg/L	0.001	6/12/2006 11:27:00	JP
Cadmium (Dissolved)	EPA 200.7	**0.008**	mg/L	0.005	6/12/2006 11:27:00	JP
Calcium (Dissolved)	EPA 200.7	**37.1**	mg/L	0.1	6/13/2006 10:33:00	JP
Chromium (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Cobalt (Dissolved)	EPA 200.7	**0.043**	mg/L	0.001	6/12/2006 11:27:00	JP
Copper (dissolved)	EPA 200.7	**0.143**	mg/L	0.001	6/12/2006 11:27:00	JP
Iron (Dissolved)	EPA 200.7	**0.31**	mg/L	0.05	6/12/2006 11:27:00	JP
Lead (dissolved)	EPA 200.7	**0.035**	mg/L	0.005	6/12/2006 11:27:00	JP
Magnesium (Dissolved)	EPA 200.7	**9.01**	mg/L	0.05	6/13/2006 10:33:00	JP
Manganese (Dissolved)	EPA 200.7	**1.681**	mg/L	0.005	6/12/2006 11:27:00	JP
Nickel (Dissolved)	EPA 200.7	**0.083**	mg/L	0.005	6/12/2006 11:27:00	JP
Selenium (Dissolved)	EPA 200.7	<	mg/L	0.001	6/12/2006 11:27:00	JP
Silver (Dissolved)	EPA 200.7	**0.012**	mg/L	0.005	6/12/2006 14:26:00	JP
Thallium (Dissolved)	EPA 200.7	<	mg/L	0.001	6/12/2006 11:27:00	JP

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

Total Potassium	EPA 200.7	**15.3**	mg/L	3.5	6/13/2006 10:33:00	JP
Vanadium (Dissolved)	EPA 200.7	<	mg/L	0.005	6/12/2006 11:27:00	JP
Zinc (dissolved)	EPA 200.7	**1.283**	mg/L	0.005	6/12/2006 11:27:00	JP
Sodium (Dissolved)	SM-3111 B	**17.80**	mg/L	0.05	6/13/2006 10:22:00	JP
Mercury (Dissolved)	SM-3112 B	**0.0003**	mg/L	0.0002	6/13/2006 10:11:00	WK

Comments for Sample I 0606171-002

No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

0606171-002

ATTACHMENT 3

HERCULES

Northern Property Boundary Assessment Report
Hercules – Aqualon Division
Hopewell, Virginia

Prepared for:

Hercules Incorporated

Aqualon Division

1111 Hercules Road

Hopewell, Virginia 23860-5245

Prepared by:

Groundwater & Environmental Services, Inc.

Exchange Alley Building

23 South 13th Street, Suite 201

Richmond, Virginia 23219

December 2007

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1.0 INTRODUCTION

Groundwater and Environmental Services, Inc. (GES) was contracted by Hercules Incorporated (Hercules) – Aqualon Division to:

- perform a subsurface investigation to evaluate the potential source of low pH and elevated zinc in the stormwater along the northern property boundary at the Hopewell facility; and
- to comment on the potential effectiveness of the plan to line the storm sewer lateral underneath the railroad tracks to the north of the Hercules property and the northern manhole on the Hercules property.

The facility is located at 1111 Hercules Road in Hopewell, Virginia. **Figure 1** shows the location of the site property on the USGS topographic quadrangle map for Hopewell, Virginia. The investigation area is depicted on **Figure 2**.

2.0 BACKGROUND

Due to the detection of dissolved zinc concentrations at Outfall 005, the facility conducted an extensive outfall sampling program in 2005 and 2006 upstream of Outfall 005 to the northern manhole (NMH) right at the property line. It should be noted that there are no known (historical or current) process areas, waste treatment, or disposal areas in the NMH area. The July 2005 report concluded that the "source" of the zinc (and low pH) is situated upgradient of the NMH located along the northern property boundary. Utility maps of the area, coupled with visual observations, confirmed the presence of a storm sewer line below the railroad tracks to the north of the NMH. Visual observations made at the time of this assessment noted sulfur railcars and several piles of sulfur scattered on the ground just north of the Hercules property.

In May 2006, GES installed a piezometer (NMH-1) in close proximity to the NMH in order to evaluate the pH of the groundwater in this area of the facility. The data from this assessment indicated that the shallow groundwater exhibited a low pH (4.12 S.U.) and the dissolved zinc was nearly two orders of magnitude higher than the concentrations measured in other wells at the facility. The findings of these two assessments indicate that the groundwater and surface water adjacent to Hercules' northern property line are being influenced by an off-site, upgradient source(s).

3.0 PROJECT OBJECTIVE

The primary objective of this focused assessment was to determine if the proposed lining of the sewer line coming onto the Hercules site and the NMH will result in the reduction of dissolved zinc concentrations at Outfall 005. The assessment activities were designed to confirm the findings of the previous stormwater and groundwater data and to expand the assessment footprint to evaluate the lateral (east-west) and vertical (north-south) extent of the low pH groundwater entering the Hercules site from the north.

4.0 ASSESSMENT ACTIVITIES

4.1 PIEZOMETER INSTALLATION

On August 14, 2007, GES personnel mobilized to the site to install four (4) additional piezometers along the northern boundary of the site property, south of the adjacent railroad right-of-way. The purpose of the proposed piezometers was to evaluate the lateral (east-west) and vertical (north-south) extent of the low pH groundwater entering the Hercules site from the north. On August 14, 2007 piezometer NMH-3 was installed approximately 700 feet west of the north manhole and approximately 40 feet south of the northern property boundary, in a gravel area located along the northern side of the Hercules building. Piezometer NMH-6 was installed south of the north manhole and just west of the associated sewer line in the area located behind the Hercules training center. On August 15, 2007, piezometer NMH-4 was installed approximately 480 feet west of the north manhole and approximately five feet south of the northern property line in the roadway. Piezometer NMH-5 was installed approximately 370 feet west of the north manhole and approximately 40 feet south of the northern property boundary, in a gravel area located along the northern side of the Hercules building. Surveyed piezometer locations in relation to the northern property boundary and north manhole are depicted on **Figure 2**.

Installation activities were conducted by a two-man crew from Parratt-Wolff Inc. of Hillsborough, North Carolina, under the direction of an experienced GES field scientist. A private utility markout was contracted to screen each of the proposed locations prior to drilling. Prior to the well installation, Parratt-Wolff personnel cored or jackhammered the concrete (if drilling in the roadway), and hand-augered to approximately four feet below ground surface (ft bgs) to further clear for potential underground utilities.

The well installations were performed using direct-push technology with a tractor-mounted rig. NMH-3 was installed to a terminal depth of 27 ft bgs and was screened from 17 to 27 ft bgs. NMH-4 was installed to 15 ft bgs and was screened from 5 to 15 ft bgs. NMH-5 was installed to 17 ft bgs and was screened from 7 to 17 ft bgs. NMH-6 was installed to 20 ft bgs and was screened from 10 to 20 ft bgs. Each

piezometer was completed with 10 feet of 1-inch 10-slot PVC screen and 1-inch solid PVC riser extending to the ground surface. Filtration-grade #2 sand (filter sand) was used to pack the annular space to at least 1 foot above the screened interval. A bentonite seal of approximately 1 foot was placed above the filter sand and the remainder of the annular space was grouted with Portland cement to the ground surface. All wells were sealed with a locking, watertight expandable gripper plug, and protected at the surface by 6-inch protective steel casings with locking covers. Each well was surveyed by a licensed Virginia surveyor (Koontz-Bryant, P.C.) and added to the facility mapping. A summary of the depth of installation and screened intervals for each of the piezometers in presented in **Table 1**.

4.2 SOIL SAMPLING

During piezometer installation, soil samples were collected on a continuous basis to the termination depth of each boring. GES logged each boring and noted any changes in lithology, color, and moisture with depth. No visual or olfactory evidence of environmental impacts was identified during the soil sampling or well installation activities. Representative soil samples were collected from the four-foot sample sleeves, mixed with deionized water into a slurry, and tested for pH using an Oakton pH meter. To ensure accuracy, the pH meter was calibrated twice a day using a three-point calibration method with 4.01, 7.0, and 10.0 calibration solutions. During drilling activities, water was observed in soil lithology at depths ranging from 10 to 24 ft bgs. Following well completion, water levels became static at approximately 7 to 25 ft bgs in NMH-3, NMH-4, NMH-5, and NMH-6.

Boring logs for each piezometer summarizing the observed lithology, water levels, pH soil screening results, and well construction information are included in **Attachment A**. The soil pH results for each boring are also included in **Table 2**.

Disposable sampling materials and nitrile sampling gloves were disposed of onsite as nonhazardous solid waste. Soil cuttings and soil sample remnants were placed in a clean fiber drum for proper disposal by Hercules pending analytical testing results.

4.3 PIEZOMETER GROUNDWATER SAMPLING

On August 15 and 16, 2007, GES personnel conducted piezometer development and sampling activities for the newly installed piezometers (NMH-3, NMH-4, NMH-5, and NMH-6) as well as the piezometer (NMH-1) previously installed in May 2006. It should be noted that no rainfall was recorded at the site for nine days prior to the beginning of sampling activities on August 15, 2007.

Prior to sampling, each piezometer was purged with a peristaltic pump and disposable polyethylene tubing until either a turbid-free discharge was obtained or the well ran dry. During purging activities for NMH-1, NMH-3, and NMH-6, the water level in

the well was quickly drawn down, indicating a low level of recharge from the surrounding formation. Piezometers NMH-4 and NMH-5 did not run dry during purging activities.

Once groundwater levels recharged to the well or the water levels remained stable during purging, water quality samples were collected and analyzed in the field for pH, dissolved oxygen, conductivity, temperature, and oxidation-reduction potential for piezometers NMH-1, NMH-4, NMH-5, and NMH-6. Piezometer NMH-3 did not produce measurable quantities of water sufficient for the water quality meter and flow-through-cell so water quality parameters were not recorded. However, enough water (approximately 200 milliliters) was purged from NMH-3 to allow GES personnel to collect a pH reading using a hand-held Oakton pH meter. Water quality parameters recorded for the other piezometers are presented in **Table 3**.

Following the collection of water quality parameters, aqueous samples were field-filtered using a 0.45 micron filter and collected from NMH-1, NMH-4, NMH-5, and NMH-6 in laboratory-provided bottleware. The samples were stored onsite at Hercules' environmental lab in a temperature-controlled refrigerator with proper chain-of-custody and were subsequently analyzed for dissolved metals (zinc, copper, silver, and nickel) via Method 200.7 by Universal Laboratories (Universal) of Hampton, Virginia. The groundwater quality analytical results are summarized in **Table 4**. The complete analytical report is included in **Attachment B**.

Disposable sampling materials, including the downhole polyethylene tubing, silicon pump tubing, and nitrile sampling gloves, were disposed of onsite as nonhazardous solid waste.

On September 27, 2007, GES personnel returned to the site to collect an additional round of pH readings of the groundwater from each piezometer (see **Table 1**). It should be noted that there was no rainfall for five days prior to the second round of pH readings.

4.4 STORM DRAIN MANHOLE SURFACE WATER SAMPLING

On August 20, 2007, pH readings were recorded for aqueous samples collected from the seven (7) storm drain manholes (SDM-01 through SDM-07) previously monitored in July 2005 as well as the north manhole (NMH), a manhole (SDM-08) located approximately 190 feet east of SDM-01 along the northern property boundary, and a manhole (SDM-09) located immediately north of the training center building (see **Figure 2**). The pH readings for each storm drain manhole as well as the varying manhole depth measurements are presented in **Table 5**. It should be noted that between the dates of August 16 and August 19, 2007, a total of 4.68 inches of rain was recorded at the site. Surveyed storm drain manhole locations are depicted on **Figure 2.**

Aqueous samples were also collected from each storm drain manhole for environmental analysis, with the exception of SDM-09, which did not have sufficient

water for a sample. The samples were collected using a swing-sampler fitted with clean, laboratory bottleware. The aqueous samples were then transferred to laboratory-provided bottleware preserved with nitric acid in the field. The environmental samples were containerized and handled in a similar manner as described above; however, these samples were not field-filtered. The aqueous samples were analyzed for total metals (zinc, copper, silver, and nickel) via Method 200.7 by Universal. The stormwater quality analytical results are summarized in **Table 6**. The complete analytical report is included in **Attachment B**.

Disposable sampling materials, including the polyethylene sampling bottles and nitrile sampling gloves, were disposed of onsite as nonhazardous solid waste.

On September 27, 2007, GES personnel returned to the site to collect an additional round of pH readings of the water in the manholes. These data are presented in **Table 5**. It should be noted that there was no rainfall for five days prior to the second round of pH measurements; however, there was sufficient flow in each of the manholes to collect a representative sample. In addition, on September 18, 2007, Hercules added lime to SDM-09 in order to control the pH levels measured in the storm drains extending further south (SDM-02, SDM-03, and SDM-04) toward Outfall 005.

On October 5, 2007, GES subcontracted a Virginia certified surveyor (Koontz-Bryant, LLC of Richmond, Virginia) to survey the northings and eastings of each new piezometer and the storm drain manholes included as part of this assessment. The surveyor also measured invert elevations of the sewer line at each storm drain manhole location. The survey results were utilized by GES to create an updated site map of the northern property boundary (**Figure 2**) and hydrogeologic cross-section (**Figure 3**). Well depths and groundwater elevations are presented in **Table 1**.

As noted in **Figure 3**, a shallow sand (with some silt) unit was encountered in the borings from NMH-1, NMH-4, and NMH-5 just below grade to a depth of 11 to 17 ft bgs. At these locations, stabilized water levels were observed at depths ranging between 7.6 and 12.2 ft bgs. A laterally pervasive clay layer, ranging in thickness from 2 to 9 feet, was observed in all borings along the northern property line. A shallow clay lens was encountered in NMH-3 between 6 and 12 ft bgs. While moist sands were observed below the shallow clay, the small vertical thickness was not deemed sufficient to set a well at this depth.

5.0 RESULTS

5.1 SOIL pH RESULTS

NMH-3 exhibited the lowest pH (4.47 S.U.) in the soil sample collected from 4-6 ft bgs. The approximate observed water table level at the time of piezometer installation was 25 ft bgs. NMH-4 exhibited the lowest pH values in the soil samples collected from 6-8 ft bgs (3.26 S.U.) and 8-10 ft bgs (3.5 S.U.). The approximate observed water table level at the time of piezometer installation was 8 ft bgs. NMH-5 exhibited pH values of 3.4 S.U. and 3.97 S.U. in the soil samples collected from 10-12 ft bgs and 12-14 ft bgs, respectively. The approximate observed water table level at the time of piezometer installation was 10 ft bgs. NMH-6 exhibited pH values of 4.84 S.U., 4.84 S.U., and 4.98 S.U. in the soil samples collected from 8-10 ft bgs, 16-18 ft bgs, and 18-20 ft bgs, respectively. The approximate observed water table level at the time of piezometer installation was 18 ft bgs.

A summary of the soil sample pH results for the four newly installed piezometers are presented in **Table 2**. With the exception of NMH-3, these data suggest that lower pH values exist deeper in each boring in proximity to where saturated conditions were observed, or at least within the likely range of seasonal water table fluctuations. This observation suggests that the "source" of the lower pH surface and groundwater is migrating onto the site and not vertically downward from a shallow soil source at the piezometer location.

5.2 GROUNDWATER pH RESULTS

5.2.1 August 15 and 16, 2007 Results

NMH-1 exhibited a groundwater pH of 3.49 S.U. with a depth to water of 12.2 ft below top of casing (btoc). NMH-3 exhibited a groundwater pH of 7.37 with a depth to water of 24.88 ft btoc. NMH-4 exhibited a groundwater pH of 3.78 S.U. with a depth to water of 7.6 ft btoc. NMH-5 exhibited a pH of 3.97 S.U. with a depth to water of 9.75 ft btoc. NMH-6 exhibited a groundwater pH of 6.36 with a depth to water of 17.4 ft btoc.

Piezometers NMH-1, NMH-4, and NMH-5 are all screened in the shallow sands and are situated either directly adjacent to the northern property line (NMH-1 and NMH-4) or across the road (NMH-5). When compared to the pH levels measured in wells that are associated with a former wastewater unit approximately 600 feet to the south of the northern property line, these pH values are between 2.43 S.U. and 3.16 S.U. lower. The pH measured in NMH-6, which is situated approximately 150 feet south of the northern property line exhibited a pH similar to the wells mentioned above;

however, this well may be influenced (buffered) by the lime that has been added to SDM-09 by Hercules.

5.2.2 September 27, 2007 Results

NMH-1 exhibited a groundwater pH of 3.63 S.U with a depth to water of 12.45 ft btoc. NMH-3 exhibited a groundwater pH of 5.13 S.U. with a depth to water of 24.59 ft btoc. NMH-4 exhibited a groundwater pH of 3.67 S.U. with a depth to water of 7.7 ft btoc. NMH-5 exhibited a pH of 3.43 S.U. with a depth to water of 9.8 ft btoc. NMH-6 exhibited a pH of 6.27 S.U. with a depth to water of 18.69 ft btoc.

The pH readings recorded in September 2007 were generally consistent with the pH readings collected in August 2007 with the exception of NMH-3. The September 2007 groundwater pH for NMH-3 was 5.13 S.U. which was 2.24 S.U. lower than the August 2007 groundwater pH of 7.37 S.U.

A summary of the pH results from both sampling events is presented in **Table 1** and shown on **Figure 2**.

5.3 GROUNDWATER ANALYTICAL RESULTS

The groundwater samples collected from NMH-1, NMH-4, NMH-5, and NMH-6 on August 15 and 16, 2007 exhibited concentrations of dissolved copper, nickel, and zinc. Dissolved silver was not detected in any of the piezometers sampled. Concentrations of dissolved metals detected in each piezometer are summarized in **Table 4**.

When the data from the piezometers closest to the northern property line (NMH-1, NMH-4, and NMH-5) are compared to dissolved concentrations of the same constituents measured recently (June 2007) in wells that are associated with a former wastewater unit approximately 600 feet to the south of the northern property line, these levels are an order of magnitude higher. The groundwater concentrations further south (NMH-6) were similar to the concentrations observed in the wells mentioned above, with the exception of nickel.

A summary of the groundwater analytical results is presented in **Table 5** and the full analytical laboratory report is included as **Attachment B**.

5.4 STORM DRAIN MANHOLE SURFACE WATER pH RESULTS

5.4.1 August 20, 2007 Results

The pH readings ranged from 3.28 S.U. to 4.38 S.U., with all but one of the pH

readings below 4.0 S.U. (see **Table 5**) . The lowest pH reading (3.28 S.U.) recorded was for the sample collected from the NMH, which is the manhole directly adjacent to Hercules' northern property boundary. As stated previously, the manhole samples were collected after a total of 4.68 inches of rain was recorded at the site between August 16 and 19, 2007. The surface water pH levels reported in August 2007 were 1 S.U. to 3.3 S.U higher than the pH levels reported in 2005 for SDM-01 through SDM-07.

5.4.2 September 27, 2007 Results

The pH readings ranged from 3.56 S.U to 7.57 S.U. (see **Table 5**). The sample collected from NMH exhibited the lowest pH reading of 3.56 S.U. The sample collected from SDM-01 exhibited a pH reading of 3.96 S.U. The pH readings for the remaining storm drain manholes ranged from 5.46 S.U. to 7.57 S.U. As stated previously, on September 18, 2007, Hercules added lime to SDM-09 in order to raise the pH levels measured in the storm drains extending further south (SDM-02, SDM-03, and SDM-04) onto the property towards Outfall 005.

A summary of the pH results from both sampling events in presented in **Table 4** and shown on **Figure 2**.

5.5 STORM DRAIN MANHOLE SURFACE WATER ANALYTICAL RESULTS

The stormwater samples collected from SDM-01 through SDM-08 and NMH on August 20, 2007 exhibited concentrations of copper, nickel, and zinc above the laboratory reporting limits (RLs). These samples were obtained following a rain event totaling 4.68 inches at the site from August 16 – 19, 2007. Silver was not detected above the RL in any of the storm drain manholes sampled. The inorganic compound concentrations detected in stormwater collected from manholes further south toward Outfall 005 were similar to concentrations detected in stormwater from manholes closer to the northern property line.

A summary of the stormwater analytical results is presented in **Table 6** and the full analytical laboratory report is included as **Attachment B**.

6.0 CONCLUSIONS

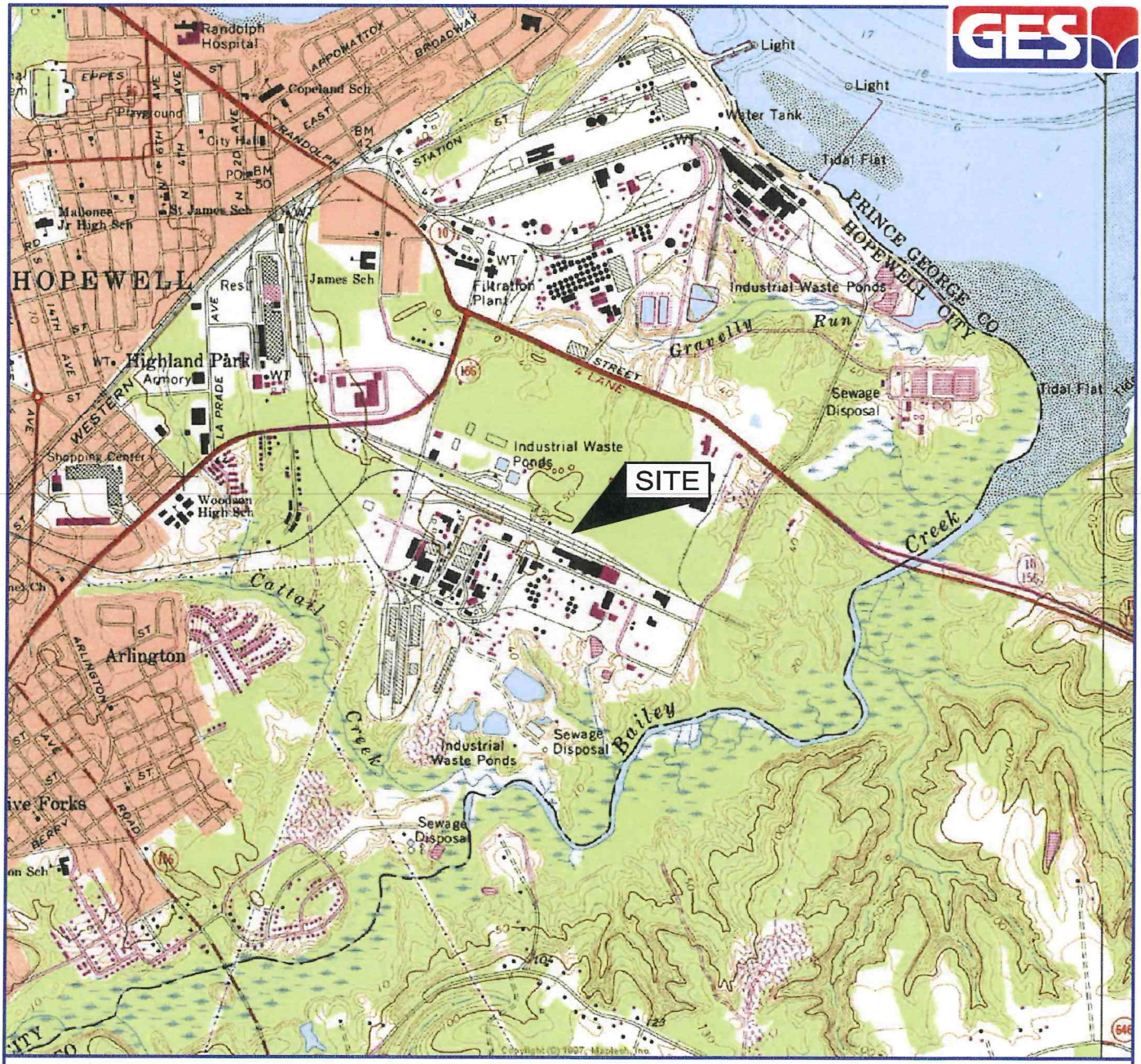
The findings of this additional assessment corroborate the initial data collected in 2005/2006 and indicate that the low groundwater pH "halo" is at least 900 feet in width and extends onto the Hercules property at least to NMH-5, which is approximately 45 feet south of the fenceline. The soil pH measurements from the borings along the northern property line indicate that the shallow (saturated) soils exhibit a relatively neutral pH and the soils in proximity to and just below the water table exhibited much lower pHs (<4.0 S.U.). The soil pH data suggest that the "source" of the low pH in soil and groundwater is not located on the Hercules property.

Based on the observation of water in the sewer manholes SDM-08 and NMH during extended periods with no precipitation, coupled with the elevation survey of the piezometers and manhole inverts, the storm sewers along the northern property line bisect the local water table. The sewers are constructed of pre-cast concrete sections and are typically bedded in gravel backfill and are generally not water tight. The data collected as part of this assessment indicate that a fairly extensive groundwater plume with a pH between 3.5 and 3.9 S.U. exists along the northern property line and is entering the sewers on the Hercules property.

The low pH groundwater has resulted in the dissolution of various inorganic compounds, namely copper and zinc that have resulted in compliance issues for Hercules at Outfall 005. The observed concentrations of these inorganic compounds are an order of magnitude higher than what has been measured in nearby wells that exhibit near neutral pH levels.

It is GES' opinion that lining the sewer line beneath the railroad tracks and the NMH would not eliminate the low pH groundwater coming from the north from infiltrating into the facility's storm sewer downgradient of the manhole. In addition, the data indicates that groundwater with a low pH extends at least 900 feet west of the NMH, and possible further to the west and east.

FIGURES



SOURCE: USGS 7.5 MINUTE SERIES
TOPOGRAPHIC QUADRANGLE 1987
HOPEWELL, VIRGINIA
CONTOUR INTERVAL = 10'

QUADRANGLE LOCATION
LAT. 037° 17' 19.86" N
LONG. 077° 16' 37.63" W
(APPROXIMATE SITE COORDINATES)

DRAFTED BY: W.A.W. (N.J.)	SITE LOCATION MAP
CHECKED BY:	HERCULES INCORPORATED AQUALON DIVISION HOPEWELL, VIRGINIA
REVIEWED BY:	
NORTH	Groundwater & Environmental Services, Inc. 23 SOUTH 13th STREET, SUITE 201, RICHMOND, VA 23219

SCALE IN FEET	DATE	FIGURE
0 2000	10-26-07	1

TABLES

Table 1
Summary of Piezometer Field Measurements
Hercules - Aqualon Division
Hopewell, Virginia

Area	Piezometer ID	Approximate Distance from Northern Property Line (ft)	Easting (X)	Northing (Y)	Ground Surface Elevation (ft)	Top of Casing (ft)	Total Depth (ft bgs)	Screen Interval (ft bgs)	8/15 - 8/16			9/27		
									DTW (ft btoc)	GW Elevation (ft)	pH (S.U.)	DTW (ft btoc)	GW Elevation (ft)	pH (S.U.)
Northern Property Boundary	NMH-1	5	3050.462	4996.8546	43.94	43.69	21	21-11	12.2	31.49	3.49	12.45	31.24	3.63
	NMH-3	40	2356.084	4954.9617	47.34	47.11	27	27-17	24.88	22.23	7.37	24.59	22.52	5.13
	NMH-4	5	2573.47	4993.4377	45.67	45.36	15	15-5	7.6	37.76	3.78	7.7	37.66	3.67
	NMH-5	40	2687.928	4954.4033	47.57	47.19	17	17-7	9.75	37.44	3.97	9.8	37.39	3.43
	NMH-6	150	3078.2	4873.2342	42.25	42.06	20	20-10	17.4	24.66	6.36	18.69	23.37	6.27

Notes:
ft bgs = feet below ground surface
ft btoc = feet below top of casing
DTW = depth to water
S.U. = standard units

Table 2
Summary of Soil Boring pH Results
Hercules - Aqualon Division
Hopewell, Virginia

Depth (ft bgs)	NMH-3 pH (S.U)	NMH-4 pH (S.U)	NMH-5 pH (S.U)	NMH-6 pH (S.U)
0-2	6.32	8.86	7.54	8.21
2-4	6.25	7.78	6.7	7.43
4-6	4.47	5.6	5.65	5.53
6-8	5.09	3.26	5.24	5.5
8-10	5.58	3.5	4.92	4.84
10-12	5.19	4.44	3.4	5.5
12-14	5.04	6.12	3.97	5.36
14-16	5.54	7.98	5.3	5.35
16-18	5.83	6.59	4.72	4.84
18-20	6.13	5.72	5.01	4.98
20-22	5.28	NS	NS	NS
22-24	5.54	NS	NS	NS
24-26	5.97	NS	NS	NS
26-28	5.99	NS	NS	NS

ft bgs = feet below ground surface
S.U. - Standard Units
NS = Not Sampled
_____ = approximate observed water level

Table 3
Summary of Water Quality Parameters
Hercules - Aqualon Division
Hopewell, Virginia

Piezometer ID	Total Depth (ft bgs)	Screen Interval (ft bgs)	Initial Water Level (ft btoc)	Date	pH (Std. units)	Temperature (°C)	Conductivity 1 (µs/cm)	Conductivity 2 (µs/cm)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)
NMH-1	21	21-11	12.20	8/15/07	3.49	25.24	NR	1456	6.45	248.9
NMH-3	27	27-17	24.88	8/15/07	7.37	NR	NR	NR	NR	NR
NMH-4	15	15-5	7.60	8/16/07	3.78	22.60	659	629	0.53	138.6
NMH-5	17	17-7	9.75	8/15/07	3.97	22.00	786	741	0.4	150.6
NMH-6	20	20-10	17.40	8/15/07	6.36	29.89	434	209	1.25	-207.6

ft bgs = feet below ground surface
S.U. = Standard Units
NR = Not Recorded

Table 4
Groundwater Sampling Analytical Results
(sampled 8/15/2007 and 8/16/2007)
Hercules - Aqualon Division
Hopewell, Virginia

Location	Analyte (mg/L)			
	Copper (dissolved)	Nickel (dissolved)	Silver (dissolved)	Zinc (dissolved)
NMH-1	0.3642	0.181	<.005	1.537
NMH-4	<.003	0.057	<.005	0.511
NMH-5	<.003	0.091	<.005	0.833
NMH-6	<.003	0.062	<.005	<.005

mg/L = milligrams per liter

Table 5
Summary of Storm Drain Manhole Field Measurements
Hercules - Aqualon Division
Hopewell, Virginia

Area	Manhole ID	Total Depth (ft bgs)	8/20/07		9/27/07		10/5/07
			DTW (ft bgs)	pH (S.U.)	DTW (ft bgs)	pH (S.U.)	DTW (ft bgs)
Storm Drain Manholes	**SDM O1**	7.5	7.25	3.69	NM	3.96	7.3
	SDM O2	15	14.7	3.48	NM	6.29*	14.28
	SDM O3	16.3	16	5.09	NM	7.11*	16.23
	SDM O4	17.3	16.86	4.38	NM	6.77*	NM
	SDM O5	13.2	12.87	3.45	NM	7.57	12.95
	SDM O6	12.6	12.3	3.71	NM	6.30	12.5
	SDM O7	11	10.76	3.75	NM	6.50	11.15
	SDM08 (along northern property line, east of SDM01)	8	7.27	3.63	NM	5.46	7.4
	SDM09 (behind training center)	11.7	NM	3.29	NM	6.14*	NM
	NMH	12	11.9	3.28	NM	3.56	11.8

ft bgs = feet below ground surface
DTW = depth to water
NM = not measured
S.U. = standard units

* - potentially affected by lime addition at SDM09

Table 6
Storm Drain Manhole Sampling Analytical Results
(sampled 8/20/2007)
Hercules - Aqualon Division
Hopewell, Virginia

Location	Analyte (mg/L)			
	Copper (total)	Nickel (total)	Silver (total)	Zinc (total)
NMH	0.3294	0.078	<.005	0.97
SDM-01	0.2098	0.132	<.005	1.91
SDM-02	0.197	0.1	<.005	1.132
SDM-03	0.2326	0.072	<.005	1.073
SDM-04	0.1432	0.116	<.005	1.199
SDM-05	0.515	0.128	<.005	1.011
SDM-06	0.17	0.111	<.005	1.255
SDM-07	0.2	0.13	<.005	1.334
SDM-08	0.2554	0.161	<.005	1.827
SDM-09	NS	NS	NS	NS

NS = Not sampled
mg/L = milligrams per liter

ATTACHMENTS

ATTACHMENT A

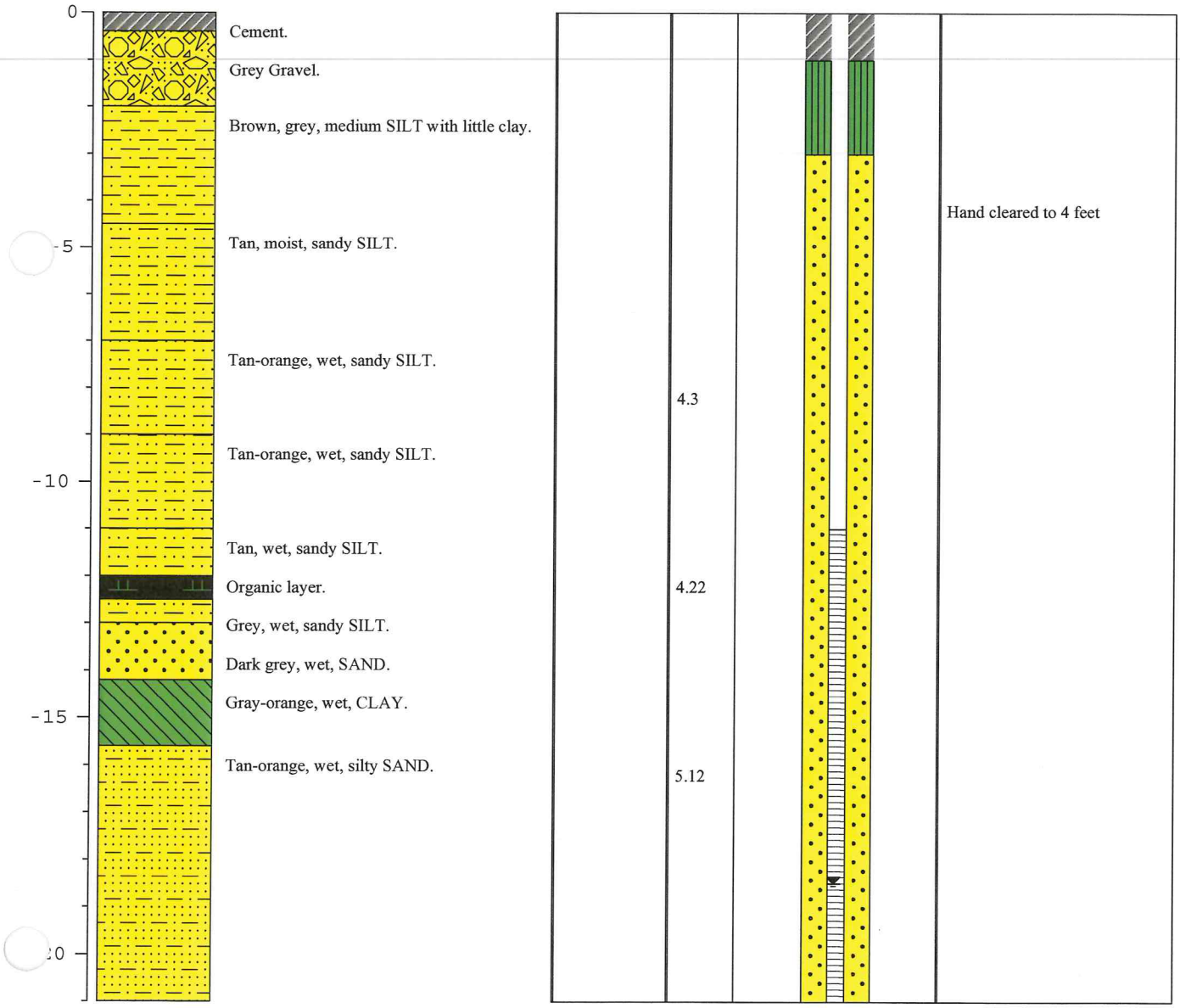
BORING LOGS AND PIEZOMETER CONSTRUCTION INFORMATION

Soil Boring Log

Borehole Number: NMH-1

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Hercules Aqualon**	DRILLING CO.:	**Parratt-Wolff**
SITE LOCATION:	**Hopewell, Virginia**	DRILLER:	**Arnold Chapel**
JOB NAME:	**1200850**	RIG TYPE:	**Geoprobe**
LOGGED BY:	**Erin Nugent**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Samuel Nicolai**	SAMPLING METHODS:	**4-foot macro-core**
DATES DRILLED:	**5-31-06**	DROP HAMMER WEIGHT	**Safety Hammer**
BOREHOLE NO.:	**NMH-1**	TOTAL DEPTH:	**21**
WEATHER: Overcast, 80s		▼ Observed Water Level	
		NA = Not Applicable	Page 1 of 1

DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	BLOW COUNT	pH	WELL CONSTRUCTION	NOTES



Soil Boring Log

Well ID: NMH-3

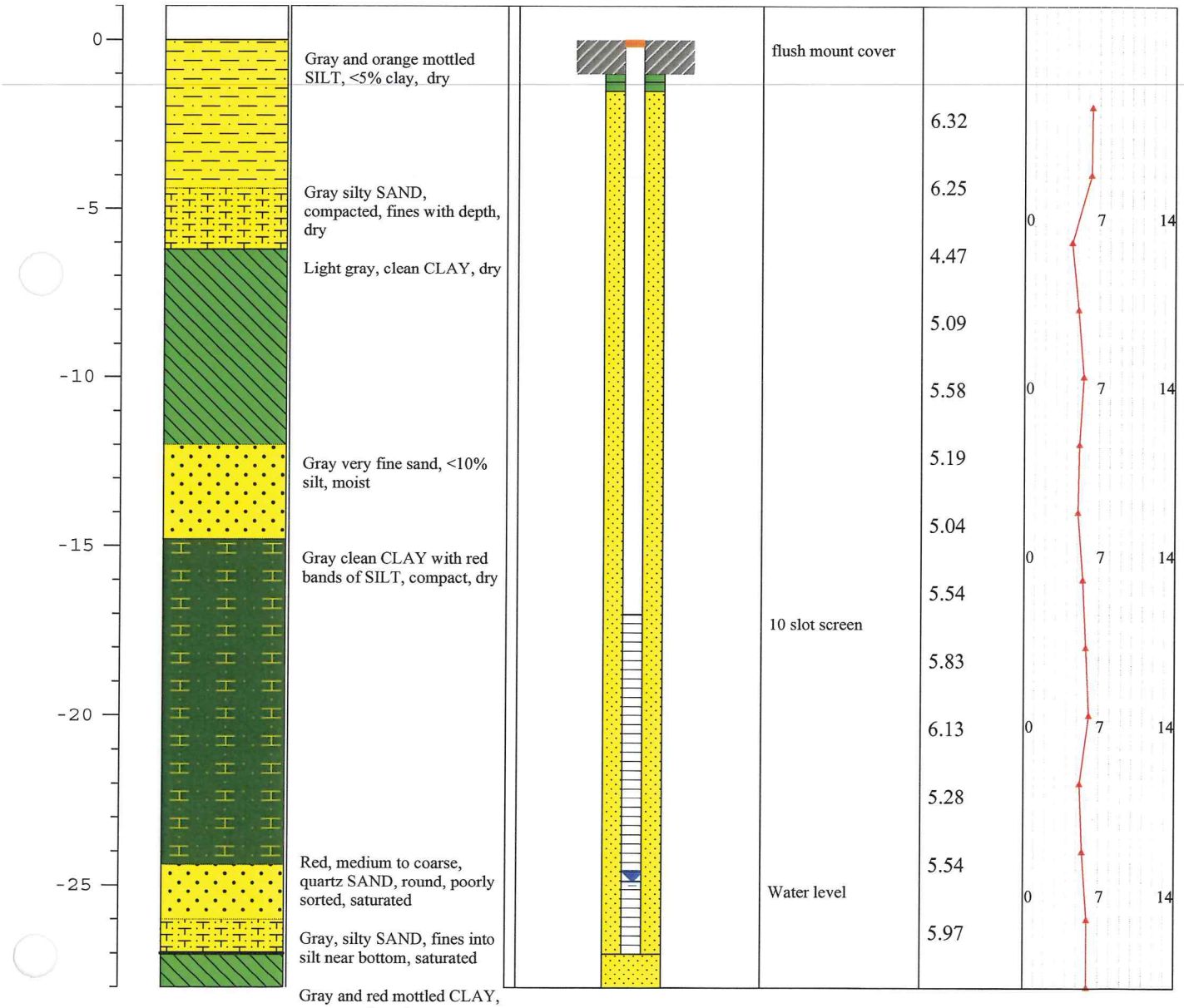
PROJECT INFORMATION

PROJECT:	**Hercules Aqualon**
SITE LOCATION:	**Hopewell, Virginia**
JOB NUMBER:	**1201057**
LOGGED BY:	**Tim Davis**
PROJECT MANAGER:	**Monty Bennett**
DATES DRILLED:	**8/14/07**
WELL ID	**NMH-3**

DRILLING INFORMATION

DRILLER:	**Louis LeFever**
BORING DEPTH:	**28 feet**
DRILLING CO.:	**Parratt-Wolff**
RIG TYPE:	**Power Probe 9600T**
METHOD OF DRILLING:	**2 inch push**
SAMPLING METHODS:	**4 foot Macro**

VERTICAL DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	WELL CONSTRUCTION	NOTES	pH
0		Gray and orange mottled SILT, <5% clay, dry		flush mount cover	6.32
-5		Gray silty SAND, compacted, fines with depth, dry			6.25
		Light gray, clean CLAY, dry			4.47
-10					5.09
		Gray very fine sand, <10% silt, moist			5.58
-15		Gray clean CLAY with red bands of SILT, compact, dry			5.19
					5.04
				10 slot screen	5.54
-20					5.83
					6.13
					5.28
-25		Red, medium to coarse, quartz SAND, round, poorly sorted, saturated		Water level	5.54
		Gray, silty SAND, fines into silt near bottom, saturated			5.97
		Gray and red mottled CLAY, compacted, moist			



Soil Boring Log

Well ID: NMH-4

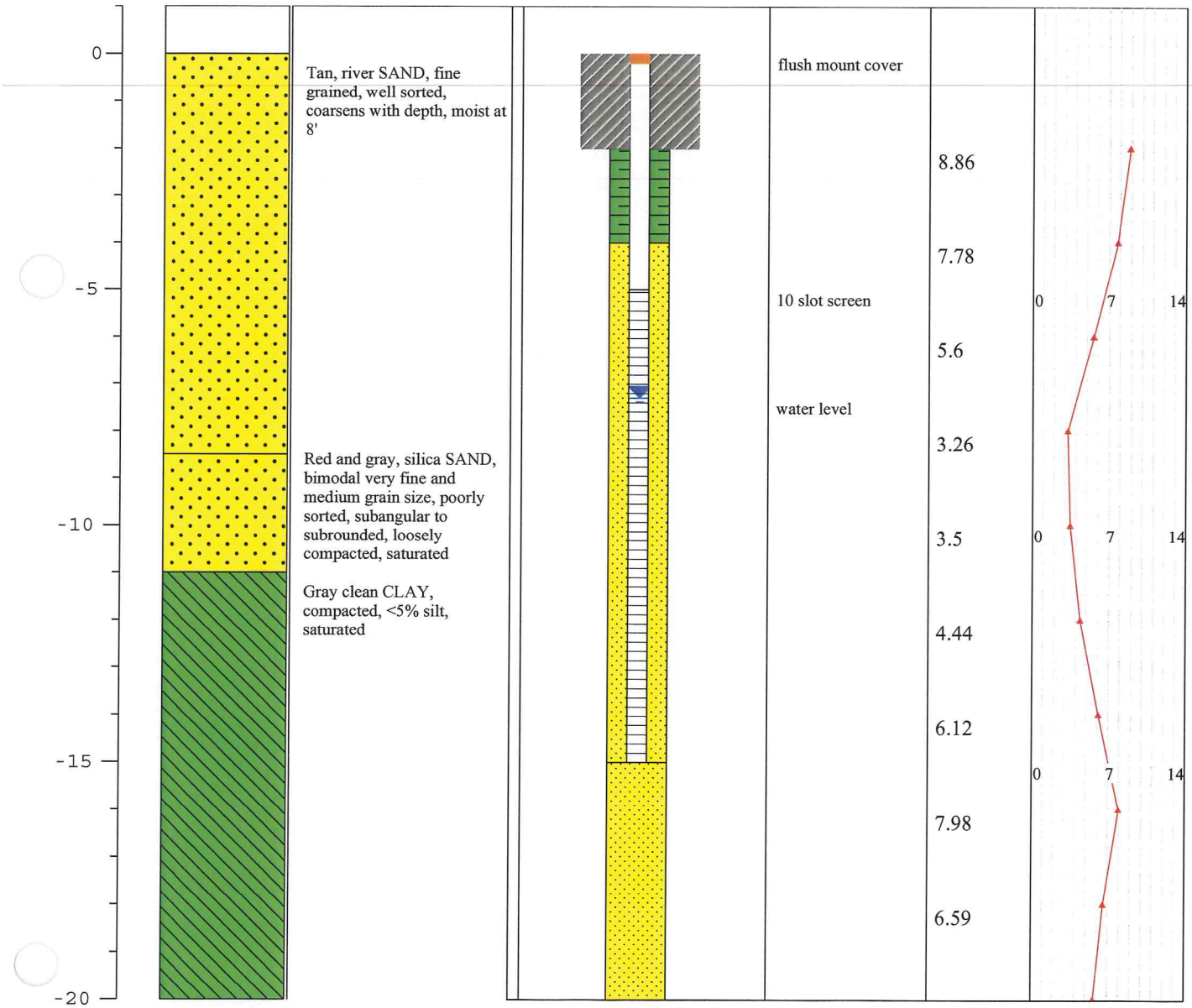
PROJECT INFORMATION

PROJECT:	**Hercules Aqualon**
SITE LOCATION:	**Hopewell, Virginia**
JOB NUMBER:	**1201057**
LOGGED BY:	**Tim Davis**
PROJECT MANAGER:	**Monty Bennett**
DATES DRILLED:	**8/15/2007**
WELL ID	**NMH-4**

DRILLING INFORMATION

DRILLER:	**Louis LeFever**
BORING DEPTH:	**20 feet**
DRILLING CO.:	**Parratt-Wolff**
RIG TYPE:	**Power Probe 9600T**
METHOD OF DRILLING:	**2 inch push**
SAMPLING METHODS:	**4 foot Macro**

VERTICAL DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	WELL CONSTRUCTION	NOTES	pH



Soil Boring Log

Well ID: NMH-5

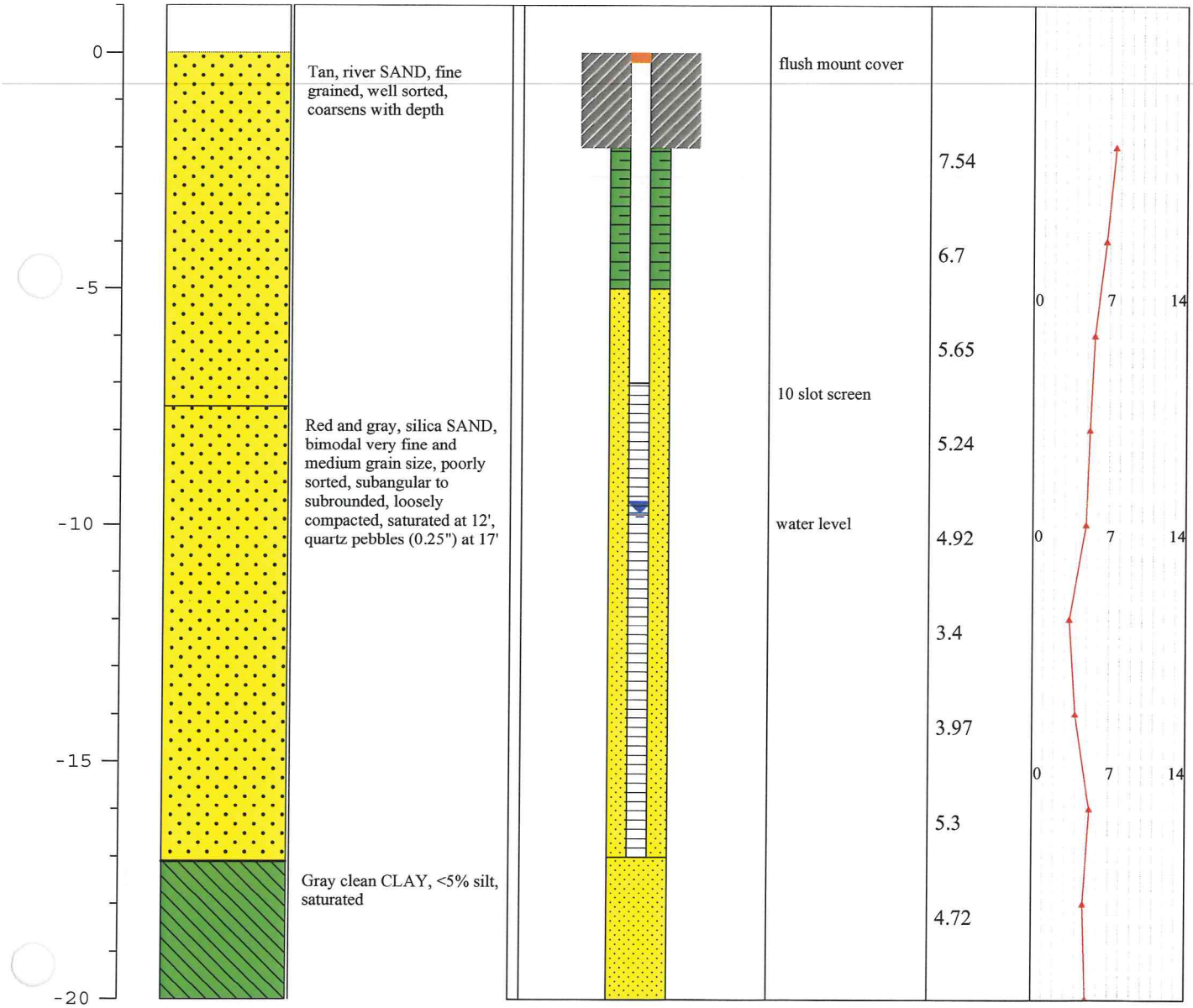
PROJECT INFORMATION

PROJECT:	**Hercules Aqualon**
SITE LOCATION:	**Hopewell, Virginia**
JOB NUMBER:	**1201057**
LOGGED BY:	**Tim Davis**
PROJECT MANAGER:	**Monty Bennett**
DATES DRILLED:	**8/15/2007**
WELL ID	**NMH-5**

DRILLING INFORMATION

DRILLER:	**Louis LeFever**
BORING DEPTH:	**20 feet**
DRILLING CO.:	**Parratt-Wolff**
RIG TYPE:	**Power Probe 9600T**
METHOD OF DRILLING:	**2 inch push**
SAMPLING METHODS:	**4 foot Macro**

VERTICAL DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	WELL CONSTRUCTION	NOTES	pH



Soil Boring Log

Well ID: NMH-6

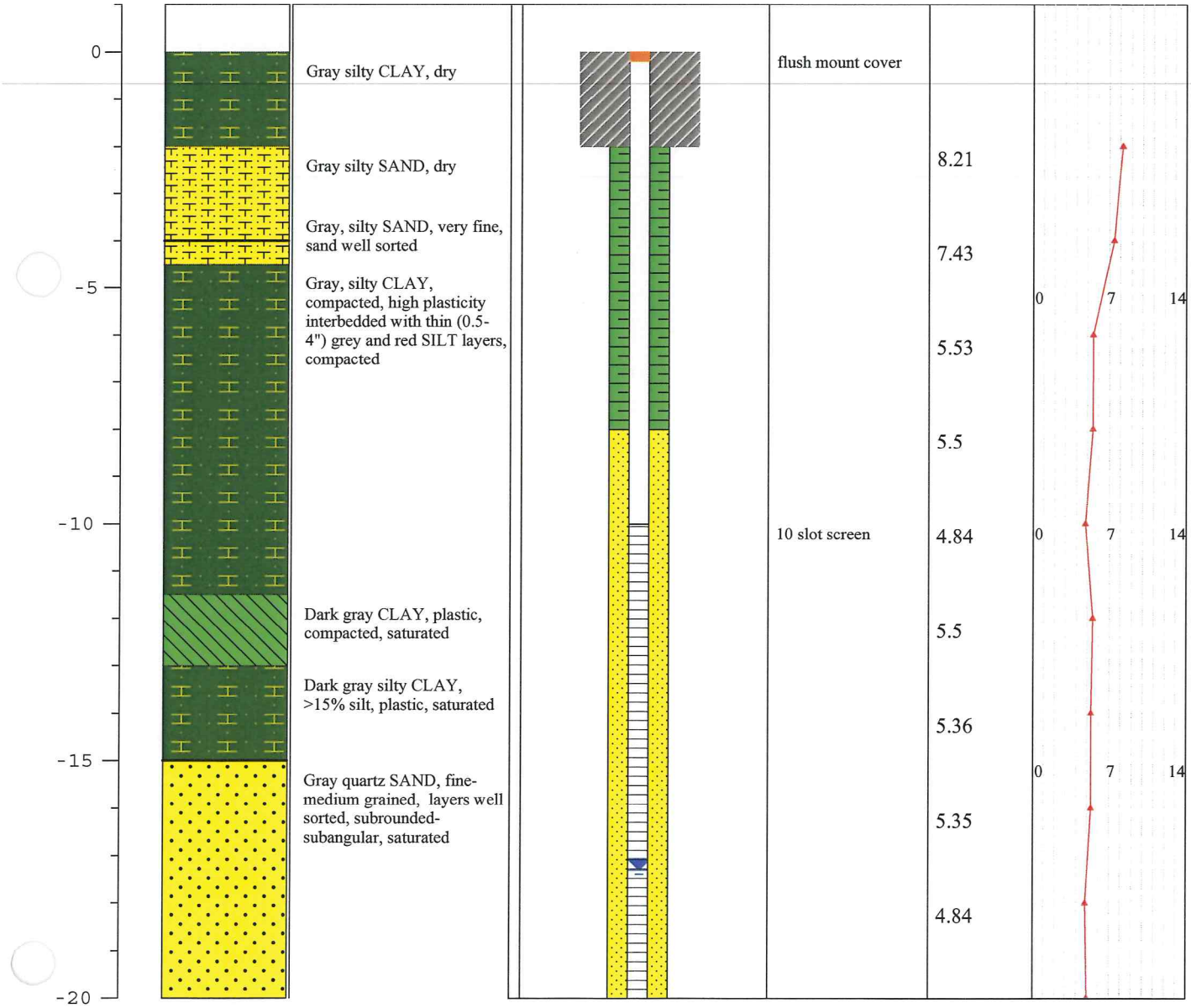
PROJECT INFORMATION

PROJECT:	**Hercules Aqualon**
SITE LOCATION:	**Hopewell, Virginia**
JOB NUMBER:	**1201057**
LOGGED BY:	**Tim Davis**
PROJECT MANAGER:	**Monty Bennett**
DATES DRILLED:	**8/14/2007**
WELL ID	**NMH-6**

DRILLING INFORMATION

DRILLER:	**Louis LeFever**
BORING DEPTH:	**20 feet**
DRILLING CO.:	**Parratt-Wolff**
RIG TYPE:	**Power Probe 9600T**
METHOD OF DRILLING:	**2 inch push**
SAMPLING METHODS:	**4 foot Macro**

VERTICAL DEPTH	SOIL/ROCK SYMBOLS	SOIL DESCRIPTION	WELL CONSTRUCTION	NOTES	pH



ATTACHMENT B

FULL ANALYTICAL DATA REPORTS

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666
1-800-695-2162
(757) 865-0880
Fax: (757) 865-8014
E-mail: info@universallaboratories.net

Date:	Tuesday, October 02, 2007
Pages:	Page 1 of 10
To:	Bill Perkinson Hercules (Hopewell Plant)
Fax#:	(804) 541-4492
From:	Mike Jennings
Subject:	Results for Project Aqualon/GES Project designated as UL Order Id 0708397 and received on Thursday, August 23, 2007

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-001

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: **0708397**

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM03
Matrix: Wastewater

UL Sample Number: **0708397-001**
Sample ID: SDM03
Grab Date/Time: 8/20/2007 11:45
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.2326**	mg/L	0.003	8/27/2007 13:33:00	EF
Nickel (Total)	EPA 200.7	**0.072**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	8/27/2007 10:27:00	EF
Zinc (Total)	EPA 200.7	**1.073**	mg/L	0.005	8/28/2007 08:30:00	EF

Comments for Sample I 0708397-001
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-001

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708397

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM01
Matrix: Wastewater

UL Sample Number: **0708397-002**
Sample ID: SDM01
Grab Date/Time: 8/20/2007 13:00
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.2098**	mg/L	0.003	8/27/2007 13:33:00	EF
Nickel (Total)	EPA 200.7	**0.132**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	8/27/2007 10:27:00	EF
Zinc (Total)	EPA 200.7	**1.910**	mg/L	0.005	8/28/2007 08:30:00	EF

Comments for Sample I 0708397-002
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-002

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TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: **0708397**

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM08
Matrix: Wastewater

UL Sample Number: **0708397-003**
Sample ID: SDM08
Grab Date/Time: 8/20/2007 13:15
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.2554**	mg/L	0.003	8/27/2007 13:33:00	EF
Nickel (Total)	EPA 200.7	**0.161**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	8/27/2007 10:27:00	EF
Zinc (Total)	EPA 200.7	**1.827**	mg/L	0.005	8/28/2007 08:30:00	EF

Comments for Sample I 0708397-003
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-003

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708397

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: NMH
Matrix: Wastewater

UL Sample Number: **0708397-004**
Sample ID: NMH
Grab Date/Time: 8/20/2007 13:40
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.3294**	mg/L	0.003	8/27/2007 13:33:00	EF
Nickel (Total)	EPA 200.7	**0.078**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	8/27/2007 10:27:00	EF
Zinc (Total)	EPA 200.7	**0.970**	mg/L	0.005	8/28/2007 08:30:00	EF

Comments for Sample I 0708397-004
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-004

UNIVERSAL LABORATORIES

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TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: **0708397**

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM04
Matrix: Wastewater

UL Sample Number: **0708397-005**
Sample ID: SDM04
Grab Date/Time: 8/20/2007 14:20
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.1432**	mg/L	0.003	9/10/2007 11:07:00	EF
Nickel (Total)	EPA 200.7	**0.116**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	8/27/2007 10:27:00	EF
Zinc (Total)	EPA 200.7	**1.199**	mg/L	0.005	8/28/2007 08:30:00	EF

Comments for Sample I 0708397-005
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

EPA LAB CODE VA00912

0708397-005

UNIVERSAL LABORATORIES

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TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708397

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM05
Matrix: Wastewater

UL Sample Number: **0708397-006**
Sample ID: SDM05
Grab Date/Time: 8/20/2007 14:30
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.515**	mg/L	0.003	9/5/2007 14:01:00	EF
Nickel (Total)	EPA 200.7	**0.128**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	8/27/2007 10:27:00	EF
Zinc (Total)	EPA 200.7	**1.011**	mg/L	0.005	8/28/2007 08:30:00	EF

Comments for Sample I 0708397-006
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-006

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: **0708397**

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM02
Matrix: Wastewater

UL Sample Number: **0708397-007**
Sample ID: SDM02
Grab Date/Time: 8/20/2007 14:50
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.197**	mg/L	0.003	9/5/2007 14:01:00	EF
Nickel (Total)	EPA 200.7	**0.100**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	9/5/2007 10:29:00	EF
Zinc (Total)	EPA 200.7	**1.132**	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708397-007
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708397

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM07
Matrix: Wastewater

UL Sample Number: **0708397-008**
Sample ID: SDM07
Grab Date/Time: 8/20/2007 15:30
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.200**	mg/L	0.003	9/5/2007 14:01:00	EF
Nickel (Total)	EPA 200.7	**0.130**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	9/2/2007 11:02:00	EF
Zinc (Total)	EPA 200.7	**1.334**	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708397-008
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

EPA LAB CODE VA00912

0708397-008

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708397

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: SDM06
Matrix: Wastewater

UL Sample Number: **0708397-009**
Sample ID: SDM06
Grab Date/Time: 8/20/2007 15:55
Composite Start: N/A
Composite Stop: N/A
Collected By: Client

Comments for Order: ***E-MAIL REPORT TO BILL PERKINSON***

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (Total)	EPA 200.7	**0.170**	mg/L	0.003	9/5/2007 14:01:00	EF
Nickel (Total)	EPA 200.7	**0.111**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Total)	EPA 200.7	<	mg/L	0.005	9/2/2007 11:02:00	EF
Zinc (Total)	EPA 200.7	**1.255**	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708397-009
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708397-009

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666
1-800-695-2162
(757) 865-0880
Fax: (757) 865-8014
E-mail: info@universallaboratories.net

Date:	Tuesday, October 02, 2007
Pages:	Page 1 of 5
To:	Bill Perkinson Hercules (Hopewell Plant)
Fax#:	(804) 541-4492
From:	Mike Jennings
Subject:	Results for Project Aqualon/GES Project designated as UL Order Id 0708398 and received on Thursday, August 23, 2007

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708398-001

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708398

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: NMH-1
Matrix: Wastewater
Comments for Order:

UL Sample Number: **0708398-001**
Sample ID: NMH-1
Grab Date/Time: 8/15/2007 14:00
Composite Start: N/A
Composite Stop: N/A
Collected By:

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (dissolved)	EPA 200.7	**0.3642**	mg/L	0.003	9/10/2007 11:07:00	EF
Nickel (Dissolved)	EPA 200.7	**0.181**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Dissolved)	EPA 200.7	<	mg/L	0.005	9/5/2007 10:29:00	EF
Zinc (dissolved)	EPA 200.7	**1.537**	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708398-001
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708398-001

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708398

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: NMH-6
Matrix: Wastewater

UL Sample Number: **0708398-002**
Sample ID: NMH-6
Grab Date/Time: 8/15/2007 15:15
Composite Start: N/A
Composite Stop: N/A
Collected By: CLIENT

Comments for Order:

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (dissolved)	EPA 200.7	<	mg/L	0.003	9/10/2007 11:07:00	EF
Nickel (Dissolved)	EPA 200.7	**0.062**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Dissolved)	EPA 200.7	<	mg/L	0.005	9/5/2007 10:29:00	EF
Zinc (dissolved)	EPA 200.7	<	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708398-002
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

EPA LAB CODE VA00912

0708398-002

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: 0708398

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: NMH-5
Matrix: Wastewater

UL Sample Number: **0708398-003**
Sample ID: NMH-5
Grab Date/Time: 8/15/2007 16:40
Composite Start: N/A
Composite Stop: N/A
Collected By: CLIENT

Comments for Order:

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (dissolved)	EPA 200.7	<	mg/L	0.003	9/10/2007 11:07:00	EF
Nickel (Dissolved)	EPA 200.7	**0.091**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Dissolved)	EPA 200.7	<	mg/L	0.005	9/5/2007 10:29:00	EF
Zinc (dissolved)	EPA 200.7	**0.833**	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708398-003
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003

North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543

EPA LAB CODE VA00912

0708398-003

UNIVERSAL LABORATORIES

20 Research Drive Hampton, Va 23666

TELEPHONE: (757) 865-0880
TOLL-FREE: (800) 695-2162
FAX: (757) 865-8014

REPORT OF ANALYSIS

Order ID: **0708398**

(REPORT DATE)
02-Oct-07

TO: **Hercules (Hopewell Plant)**
1111 Hercules Road
Hopewell Va 23860
ATTN: Bill Perkinson

Project ID: Aqualon/GES Project
Project # N/A
Site: NMH-4
Matrix: Wastewater

UL Sample Number: **0708398-004**
Sample ID: NMH-4
Grab Date/Time: 8/16/2007 09:15
Composite Start: N/A
Composite Stop: N/A
Collected By: CLIENT

Comments for Order:

Parameter	Method	Test Result	Units	UL Report Limit	Analysis Date/Time	Analyst
Copper (dissolved)	EPA 200.7	<	mg/L	0.003	9/10/2007 11:07:00	EF
Nickel (Dissolved)	EPA 200.7	**0.057**	mg/L	0.006	9/7/2007 11:14:00	EF
Silver (Dissolved)	EPA 200.7	<	mg/L	0.005	9/5/2007 10:29:00	EF
Zinc (dissolved)	EPA 200.7	**0.511**	mg/L	0.005	9/6/2007 09:31:00	EF

Comments for Sample I 0708398-004
No comments

Respectfully Submitted,

Virginia Drinking Water Lab# 00030
VDEQ Lab #000003
North Carolina Drinking Water Lab # 51706
North Carolina Wastewater/Groundwater Lab # 543
EPA LAB CODE VA00912
0708398-004

ATTACHMENT 4

Groundwater
& Environmental Services, Inc.

Exchange Alley Building • 23 South 13th Street, Suite 201 • Richmond, Virginia 23219 • (866) 222-7786 • (804) 343-0770

August 10, 2009

Via electronic mail
Mr. Steve Spence
Mr. Bill Perkinson
Ashland Aqualon Functional Ingredients
1111 Hercules Road
Hopewell, Virginia 23860

Re: Northern Property Boundary pH Assessment
2008 Investigation Summary and Recommendations
Hopewell, Virginia

Dear Mr. Spence and Mr. Perkinson:

The purpose of this letter is to document and discuss investigative activities conducted in 2008 as part of the ongoing assessment along the northern property boundary of the Ashland facility located at 1111 Hercules Road in Hopewell, Virginia and the adjacent CSXT Hopewell Yard.

Background

Following the 2007 investigation documented in the Northern Property Boundary Assessment Report (GES, dated December 2007), Ashland and CSX Transportation, Inc. (CSXT) agreed to partner in conducting additional investigation north of the CSXT railyard/right of way and along the Ashland northern property boundary. In May 2008, AMEC Earth & Environmental, Inc. (AMEC), on behalf of CSXT and Ashland, installed seven (7) piezometers (PZ-01 through PZ-07) along the CSXT property boundary north of the CSXT railroad track area. In August 2008, Groundwater & Environmental Services, Inc. (GES), on behalf of Ashland, installed four (4) additional piezometers (NMH-7 through NMH-10) along the Ashland facility northern property boundary.

A comprehensive sampling event was conducted by GES and AMEC from August 14-15, 2008 on both the CSXT property and Ashland property. The groundwater level data and pH readings collected during this sampling event are presented on **Figures 1** and **2** (attached). Based on groundwater flow direction and pH readings collected on both properties, it is GES' opinion that the source of the low pH plume detected on Ashland's property is situated to the north of Ashland's northern property boundary.

GES has further reviewed the findings and has compiled a number of comments regarding CSXT/AMEC's recommendations to slip-line the culvert to mitigate the influx of low pH groundwater into manhole NMH on Ashland's property.

Comments

The remedy proposed by AMEC on behalf of CSXT (slip-lining of the culvert below the tracks) may mitigate the influx of low pH groundwater into manhole NMH and Ashland's property; however, it is GES' opinion that it will do little to influence the migration of the low pH plume that has been identified (pH levels less than 4.00 S.U.) as far west as NMH-8 (600 feet to the west of the culvert). This is of concern for the following reasons:

a. Groundwater pH data collected in piezometer NMH-5 (2.65 S.U.) indicates that the plume has also migrated across the Aqualon Road, approximately 375 feet to the west of the NMH.

b. The network of storm sewers in the area are buried from approximately 7 to 17 feet below ground surface and flow by gravity along Aqualon Road, to the south under the warehouse building and then eastward along Quality Way. The sewers bisect the water table at some locations and as they drain towards the east and empty into the main north-south sewer leading to Ashland outfall 005. The storm sewers along Quality Way (SDM06 and SDM07) have exhibited low pH (3.71 and 3.75 S.U., respectively) during past sampling events (refer to attached table, originally included as Table 5 of GES' Northern Property Boundary Assessment Report, dated December 2007).

c. As depicted on **Figure 3**, the areal extent of the low pH plume (defined herein as a with a pH of less than 4.00 S.U.) that appears to flow (based on groundwater flow direction) towards the culvert under the tracks is relatively small (13,329 square feet or 23% of the entire plume) compared to the entire footprint of the plume (57,513 square feet) that extends as far west as NMH-8.

d. The construction of the storm sewer network at the Ashland facility consists of a non-watertight bell/spigot concrete pipe in a bed of porous sand/gravel. The bedding around the sewers serves as a preferential pathway for groundwater. As such, lining the culvert as suggested by CSXT/AMEC will not prevent the low pH groundwater from continuing to migrate along/within the bedding of the sewer network. The low pH groundwater could then enter the sewer further downgradient of the lined section of NMH where the sewer is non-lined and the joints are not watertight.

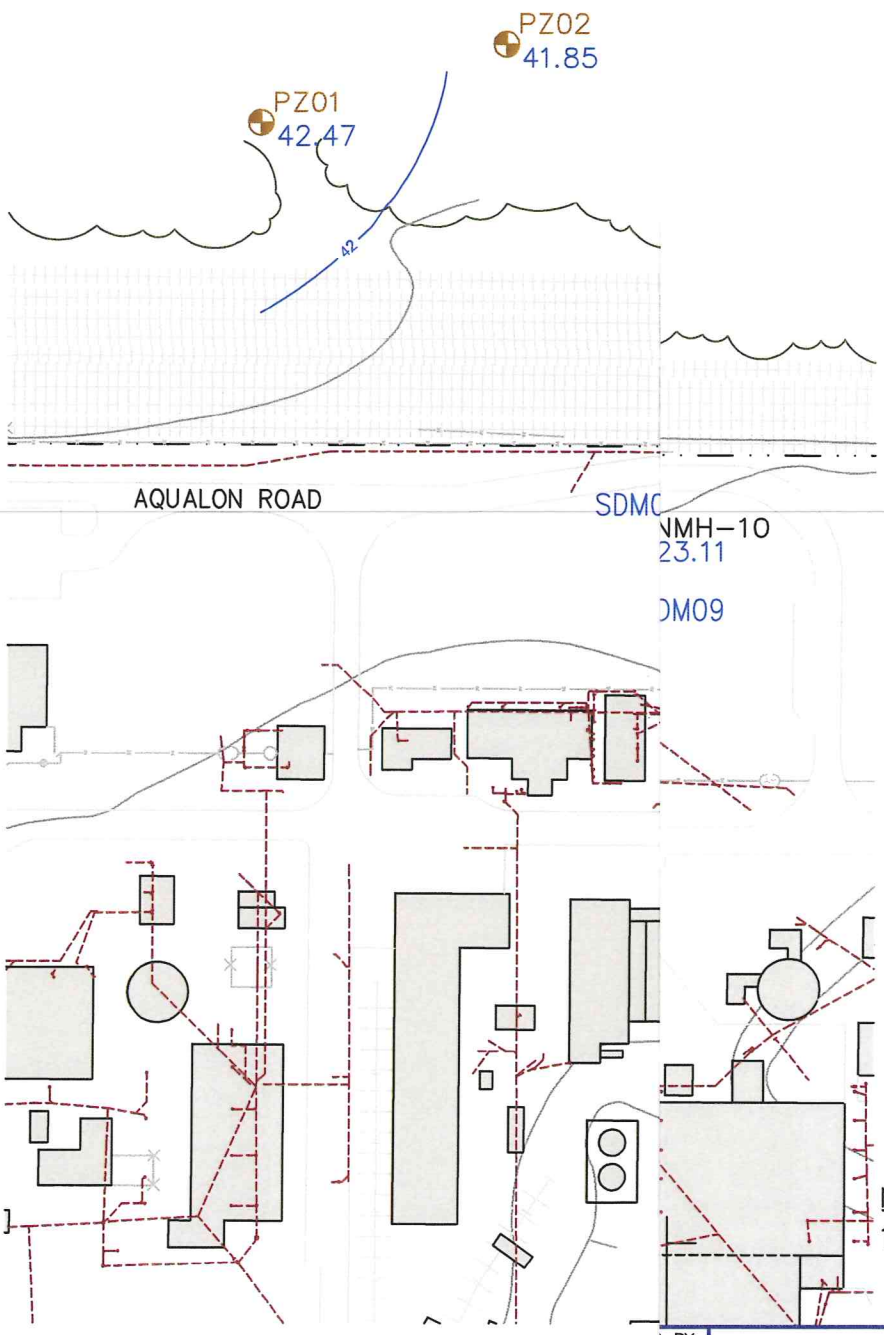
Based on the comments presented above, it is GES' opinion that the proposed slip-lining of the culvert below the tracks will do little to mitigate the low pH groundwater migrating onto and into the storm sewers on the Ashland property at locations further to the south and west of the culvert. Additional remedial efforts should be considered in order to address the overall low pH groundwater plume observed at the property boundary and locations further south.

Please do not hesitate to contact the undersigned if you have any questions or concerns.

Respectfully submitted,
Groundwater & Environmental Services, Inc.

Montgomery S. Bennett, P.G.
Senior Project Manager

Attachments: Figure 1 – Piezometer & Storm Drain Manholes with August 2008 Groundwater Contours
Figure 2 – Piezometer & Storm Drain Manholes with August 2008 pH Contours
Figure 3 – Culvert pH Capture Area
Table 5 – Summary of Storm Drain Manhole Field Measurements



LEGEND

- BUILDINGS
- STORM SEWER
- FENCELINE
- STORM DRAIN MANHOLE
- CSX PIEZOMETERS
- CULVERT STORM PIPE
- AQUALON PIEZOMETERS
- GROUNDWATER CONTOUR

NOTE:

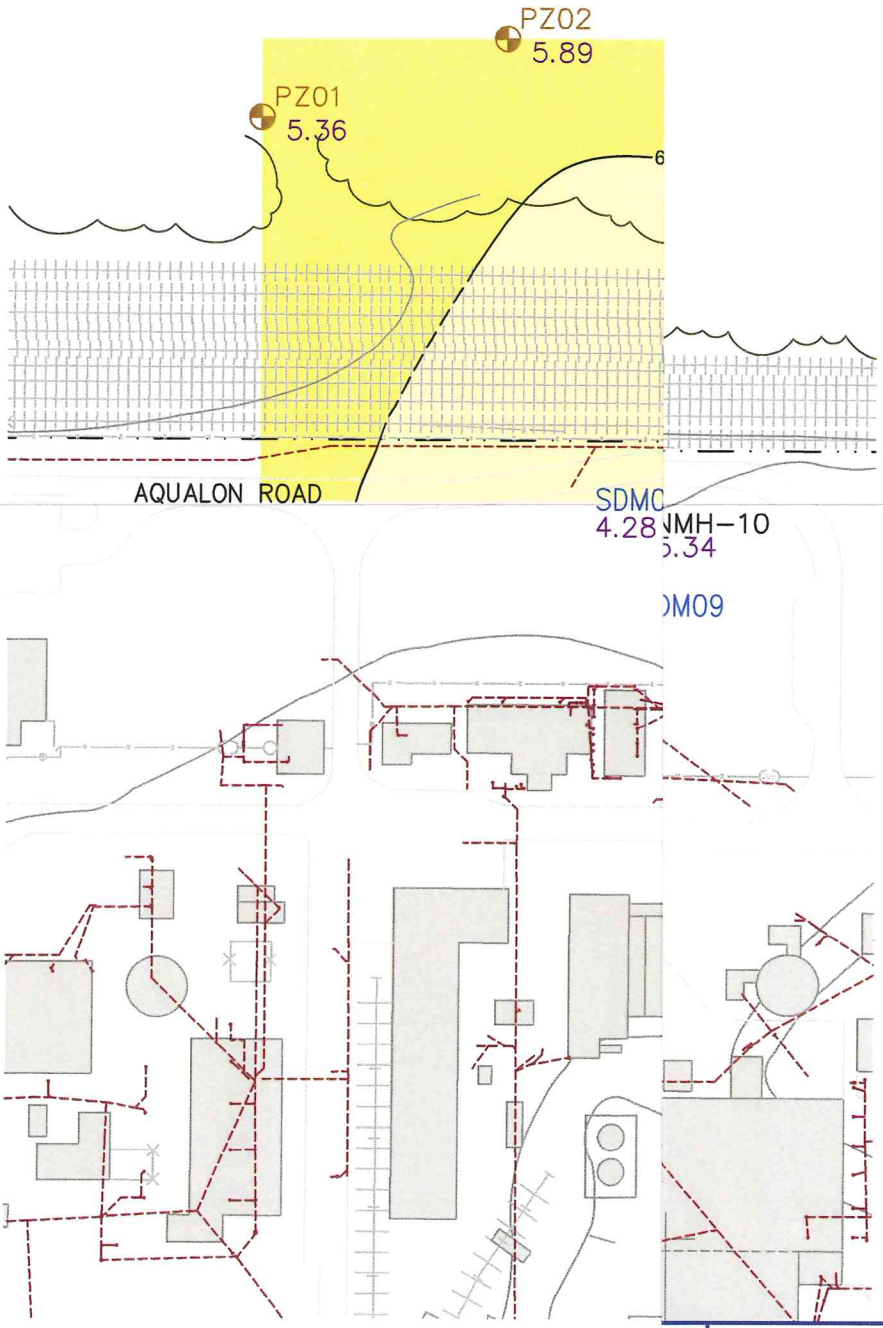
1. NMH-3 AND PZ-04 ARE NOT USED IN CONTOURS

PIEZOMETER & STORM DRAIN MANHOLES WITH AUGUST 2008 GROUNDWATER CONTOURS

HERCULES INCORPORATED
AQUALON DIVISION
HOPEWELL, VIRGINIA

Groundwater & Environmental Services, Inc.
23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219

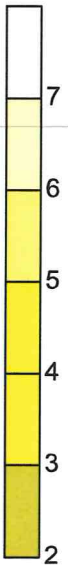
SCALE IN FEET	DATE	FIGURE
0 150	8-11-09	1



LEGEND

- BUILDINGS
- STORM SEWER
- FENCELINE
- RAILROAD TRACKS
- STORM DRAIN MANHOLE
- CSX PIEZOMETERS
- CULVERT STORM PIPE
- AQUALON PIEZOMETERS

pH READINGS (S.U.)



Ph CONTOUR DASHED WHERE INFERRED

NOTE:
1. STORM DRAINS NMH, SDM01 AND SDM08 ARE NOT USED IN CONTOURS

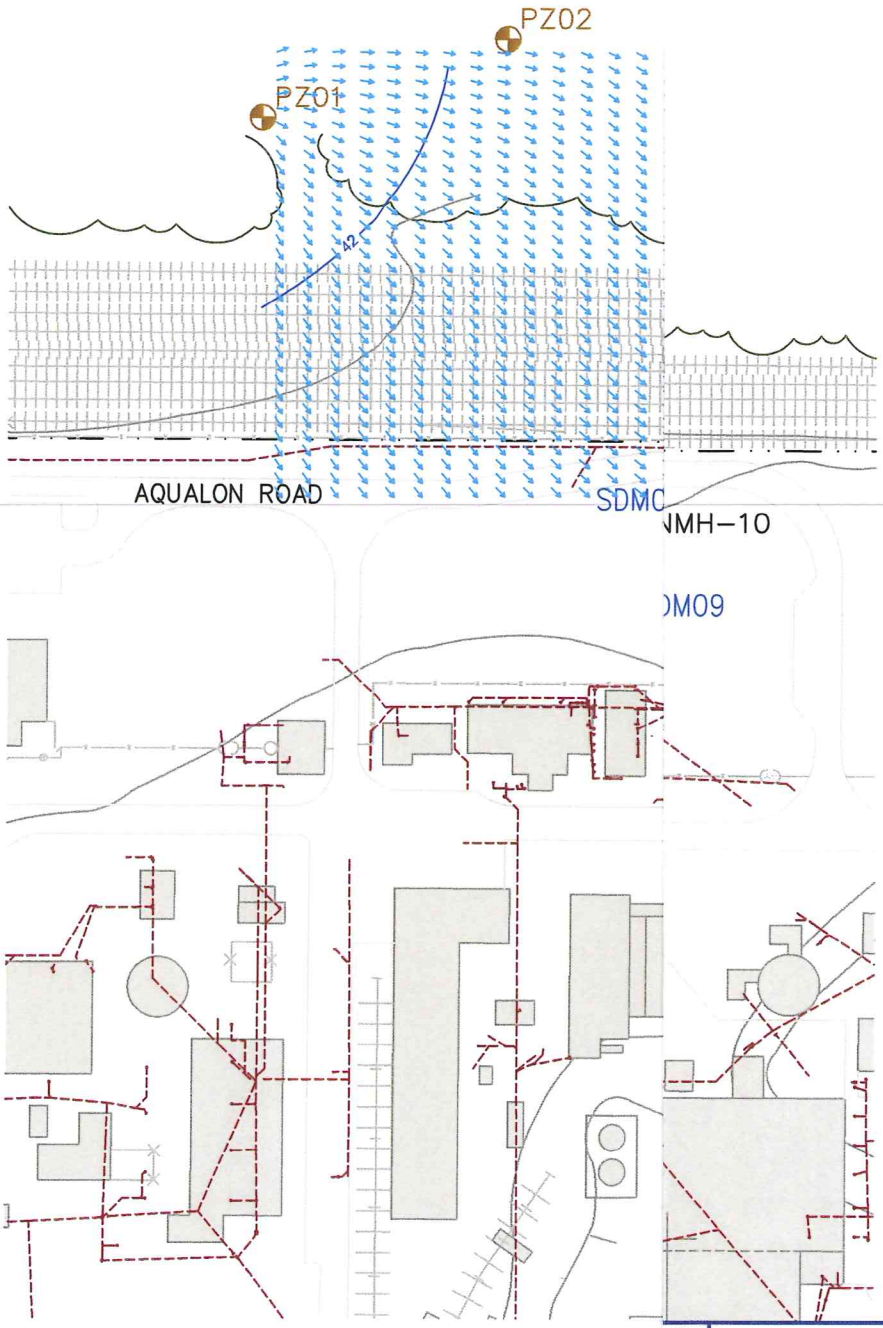
BY:
T)
BY:
BY:
H

PIEZOMETER & STORM DRAIN MANHOLES WITH AUGUST 2008 pH CONTOURS

HERCULES INCORPORATED
AQUALON DIVISION
HOPEWELL, VIRGINIA

Groundwater & Environmental Services, Inc.
23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219

SCALE IN FEET	DATE	FIGURE
0 — 150	8-11-09	2



LEGEND

- BUILDINGS
- STORM SEWER
- FENCELINE
- RAILROAD TRACKS
- STORM DRAIN MANHOLE
- CSX PIEZOMETERS
- CULVERT STORM PIPE
- AQUALON PIEZOMETERS
- GROUNDWATER CONTOUR
- CULVERT CAPTURE AREA
- GROUDWATER GRADIENT VECTORS

pH READINGS (S.U.)

7
6
5
4
3
2

Ph CONTOUR DASHED WHERE INFERRED

BY:
T)
BY:
BY:
H

CULVERT pH CAPTURE AREA

HERCULES INCORPORATED
AQUALON DIVISION
HOPEWELL, VIRGINIA

Groundwater & Environmental Services, Inc.
23 SOUTH 13TH STREET, SUITE 201, RICHMOND, VA 23219

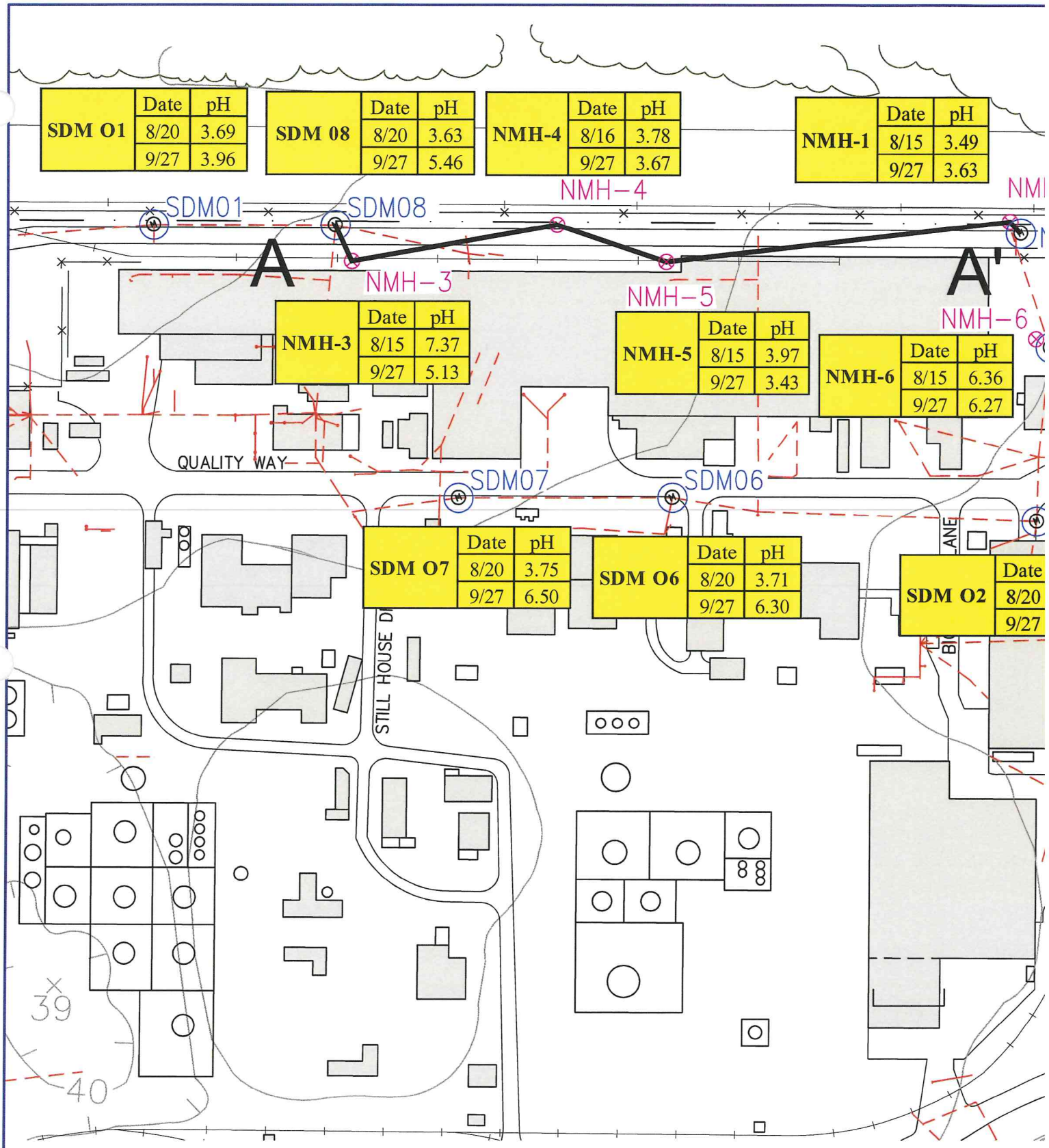
SCALE IN FEET	DATE	FIGURE
0 — 150	8-11-09	3

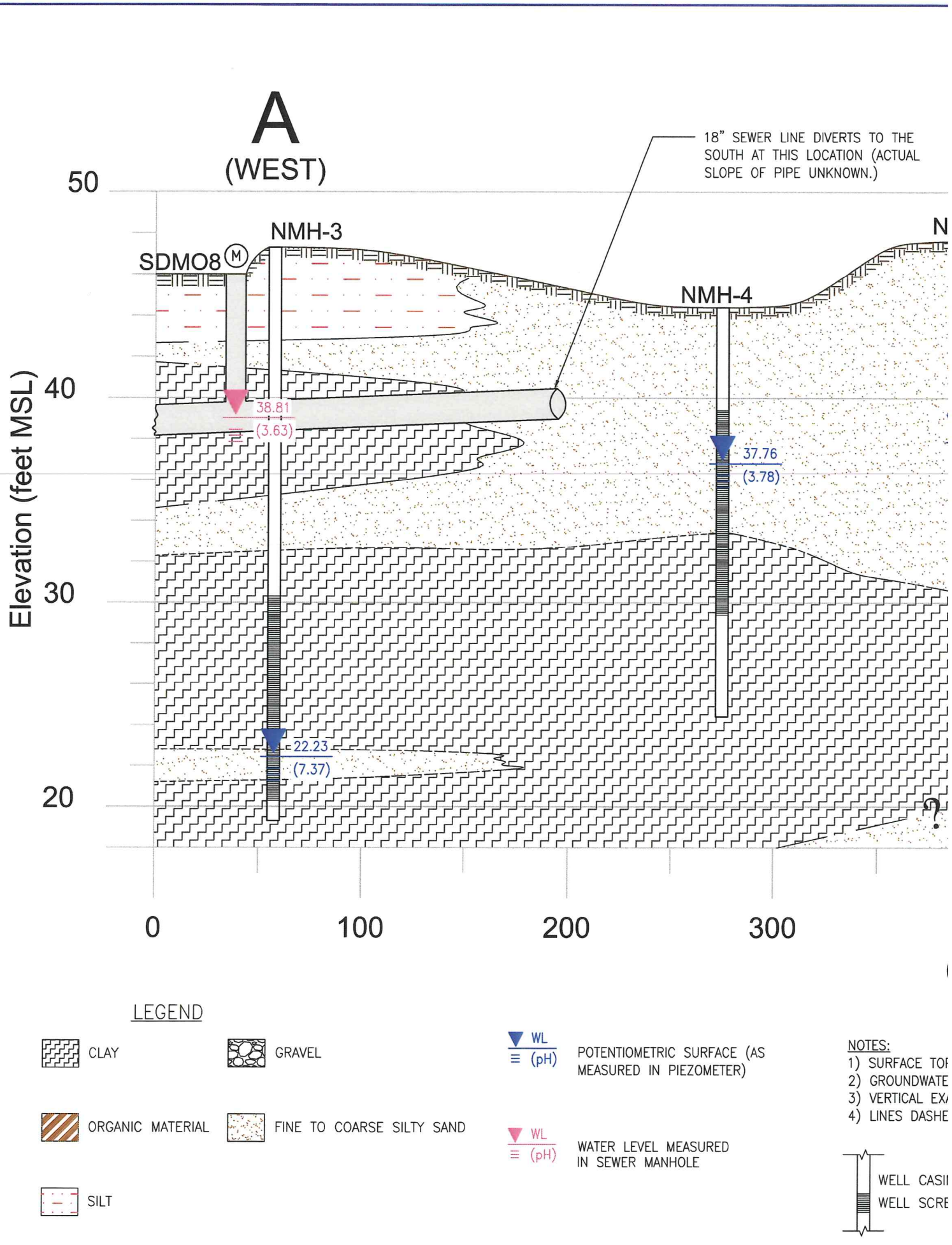
Table 5
Summary of Storm Drain Manhole Field Measurements
Hercules - Aqualon Division
Hopewell, Virginia

Area	Manhole ID	Total Depth (ft bgs)	8/20/07		9/27/07		10/5/07
			DTW (ft bgs)	pH (S.U.)	DTW (ft bgs)	pH (S.U.)	DTW (ft bgs)
Storm Drain Manholes	**SDM O1**	7.5	7.25	3.69	NM	3.96	7.3
	SDM O2	15	14.7	3.48	NM	6.29*	14.28
	SDM O3	16.3	16	5.09	NM	7.11*	16.23
	SDM O4	17.3	16.86	4.38	NM	6.77*	NM
	SDM O5	13.2	12.87	3.45	NM	7.57	12.95
	SDM O6	12.6	12.3	3.71	NM	6.30	12.5
	SDM O7	11	10.76	3.75	NM	6.50	11.15
	SDM08 (along northern property line, east of SDM01)	8	7.27	3.63	NM	5.46	7.4
	SDM09 (behind training center)	11.7	NM	3.29	NM	6.14*	NM
	NMH	12	11.9	3.28	NM	3.56	11.8

ft bgs = feet below ground surface
DTW = depth to water
NM = not measured
S.U. = standard units

* - potentially affected by lime addition at SDM09


SDM O1
Date pH
8/20 3.69
9/27 3.96
SDM 08
Date pH
8/20 3.63
9/27 5.46
NMH-4
Date pH
8/16 3.78
9/27 3.67
NMH-1
Date pH
8/15 3.49
9/27 3.63
SDM01
SDM08
NMH-4
A
A'
NMH-3
NMH-5
NMH-6
NMH-3
Date pH
8/15 7.37
9/27 5.13
NMH-5
Date pH
8/15 3.97
9/27 3.43
NMH-6
Date pH
8/15 6.36
9/27 6.27
QUALITY WAY
SDM07
SDM06
SDM O7
Date pH
8/20 3.75
9/27 6.50
SDM O6
Date pH
8/20 3.71
9/27 6.30
SDM O2
Date
8/20
9/27
STILL HOUSE
39
40


A
(WEST)
18" SEWER LINE DIVERTS TO THE SOUTH AT THIS LOCATION (ACTUAL SLOPE OF PIPE UNKNOWN.)
NMH-3
SDMO8 M
NMH-4
N
38.81
(3.63)
37.76
(3.78)
22.23
(7.37)
?
Elevation (feet MSL)
50
40
30
20
0
100
200
300
LEGEND
CLAY
GRAVEL
ORGANIC MATERIAL
FINE TO COARSE SILTY SAND
SILT
WL
≡ (pH)
POTENTIOMETRIC SURFACE (AS MEASURED IN PIEZOMETER)
WL
≡ (pH)
WATER LEVEL MEASURED IN SEWER MANHOLE
NOTES:
1) SURFACE TOP
2) GROUNDWATE
3) VERTICAL EXA
4) LINES DASHE
WELL CASI
WELL SCRE